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REPORTS

ON THE

MINERAL RESOURCES

OF THE

UNITED STATES.

REPORT

OF

J. ROSS BROWNE

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ON THE

MINERAL RESOURCES

OF THE

STATES AND TERRITORIES WEST OF THE ROCKY MOUNTAINS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1868.

LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

The report of J. Ross Browne on the mineral resources of the States and Territories west of the Rocky mountains.

MARCH 5, 1868.—Referred to the Committee on Mines and Mining and ordered to be printed.

TREASURY DEPARTMENT, *March 5*, 1868.

SIR: I have the honor to transmit to the House of Representatives the report of J. Ross Browne on the mineral resources of the States and Territories west of the Rocky mountains.

Very respectfully, your obedient servant,

H. McCULLOCH,
Secretary of the Treasury.

Hon. SCHUYLER COLFAX,
Speaker of the House of Representatives.

[redacted]

REPORT

OF

J. ROSS BROWNE,

ON

THE MINERAL RESOURCES OF THE STATES AND TERRITORIES WEST OF THE ROCKY MOUNTAINS.

WASHINGTON, D. C., *March* 5, 1868.

SIR: In the preliminary report which I had the honor to transmit to you from San Francisco in November, 1866, a general summary was given of the mineral resources of the States and Territories west of the Rocky mountains. It was not anticipated by the department that the information required under letter of instructions dated August 2, 1866, could be obtained in full within the brief period intervening before the next meeting of Congress; but it was hoped that sufficient data might be collected to furnish a general idea of the rise and progress of the mining interest on the Pacific slope. No official document in any department of the government contained accurate information on this subject, and it was considered desirable that special attention should be given to the following points:

1. The origin of gold and silver mining on the Pacific coast and present condition of that interest, as tending to show the progress of settlement and civilization.
2. Geological formation of the great mineral belts and general characteristics of the placer diggings and quartz lodes.
3. Different systems of mining, machinery used, processes of reducing the ores, percentage of waste, and net profits.
4. Population engaged in mining, exclusively and in part, capital and labor employed, value of improvements, number of mills and steam engines in operation, yield of the mines, average of dividends, and losses.
5. Proportion of agricultural and mineral lands in each district, quantity of woodland, facilities for obtaining fuel, number and extent of streams, and water privileges.
6. Salt beds, deposits of soda and borax, and all other valuable mineral deposits.
7. Altitude, character of climate, mode and cost of living, cost of all kinds of material, cost of labor, &c.
8. Population of the mining towns, number of banks and banking institutions in them, facilities for assaying, melting, and refining bullion; charges upon the same for transportation and insurance.
9. Communication with the mines and principal towns, postal and telegraphic lines; stage routes; cost of travel; probable benefits likely to result from construction of the Pacific railroad and its proposed branches.
10. Necessity for assay offices and public depositories; what financial facilities may tend to develop the country and enhance its products.
11. Copies of local mining laws and customs regulating the holding and working of claims.
12. Number of ledges opened, number claimed, character of the soil in the mining districts, and its adaptation to the support of a large population.

The preliminary report, submitted in answer to these inquiries, embraced such information as could be obtained within the brief period allowed for its preparation. Although imperfect in many respects, it was received by the people of the Pacific coast as an indication of a growing interest on the part of government in the development of our mineral resources. It was a source of gratification to the miners to find that, after years of unprofitable toil, during which they had contributed largely to the national wealth, the peculiar character of their occupation was beginning to be understood, and its influence in promoting settlement and civilization to be better appreciated.

The report which I now have the honor to submit is the result of many years of labor and exploration. It contains the aggregated experience of the ablest statisticians and experts on the Pacific coast. If there be any merit in the work, it belongs chiefly to my co-laborers, who have devoted themselves with such unselfish zeal to the promotion of the objects designed to be accomplished by this commission. The fund appropriated by Congress was insufficient to admit of compensation adequate to such labor; but assistance was cheerfully given, as a matter of public benefit, without regard to personal or pecuniary considerations. When it is taken into view that this inquiry extends over the Territories of Utah, Arizona, Montana, Idaho, and Washington, and the States of Oregon, California, and Nevada, embracing an area of country stretching from the Rocky mountains to the Pacific, and from Mexico to British Columbia; that in many parts of this vast mineral range travel is still difficult and expensive; that the business of mining is new to the American people, and the collection of statistics unsystematized in this department of industry, it will be conceded that as much has been accomplished as could reasonably be expected.

An erroneous idea prevails that the collection of mining statistics involves original explorations and detailed personal examinations of every mine throughout the vast range of our mineral regions, with scientific and practical deductions relative to the treatment of ores; and it is expected by some that the information obtained shall be entirely new, and furnish a complete index for the purchase, sale or working of every mine in the country. Apart from the fact that such an investigation would require the employment for many years of a large scientific force at great expense, it would be difficult even then to present statistics which had not already been made public. The same sources of information are open to all. The mining press of the country, closely connected with that interest, directly identified with its progress, in daily and familiar contact with its details, makes it a special duty to keep up the current record of cost and production, success and failure. There may be misstatement or exaggeration, but not more so on the part of the press, which is held to a certain accountability by public sentiment, than on that of individuals who may be prejudiced or irresponsible. Statements publicly made and thoroughly criticised are as likely to be correct as casual examinations made by persons visiting a special locality, unfamiliar with its growth and progress, and compelled after all to depend upon information derived from others. Nevertheless, it must be admitted that there are difficulties in the way of absolute accuracy.

Every miner naturally desires that his mine should be carefully examined and reported upon in detail, especially if, as in the majority of cases, it be unproductive. Without reflecting that a mere list of the unproductive mines would fill a volume, the miner is disposed to estimate the value of a report by its mention or omission of that in which he is most interested. However disposed a government agent may be to meet the wishes of the mining community in this respect, it is equally important to bear in mind that this inquiry is not designed for speculative purposes or the promotion of special or individual interests. The public desire reliable statements, and herein lies the difficulty—a spirit of exaggeration on the one hand, a demand for facts on the other. To afford satisfaction to all is impossible. I have therefore relied upon my own sense of fairness, and endeavored to present the truth impartially.

That errors may have been committed, and false statements given by interested parties, is probable, but precaution has been taken to guard against them. The selection of assistants was made with reference to their integrity and capacity. Instructions were given to them in detail, enjoining careful scrutiny and verification of every statement. The revision of their work, under these precautions, has occupied more than four months. There is no subject upon which greater difference of opinion exists than that of mining statistics. It is an open field in which there is room for discrepancy under any existing circumstances. No two persons rate the product of the precious metals alike. The superintendent of a mine often furnishes information which when submitted to the board of directors is pronounced incorrect. Representatives from the mining districts are apt to rate both population and products higher than persons who have made them special subjects of inquiry, but whose opportunities for judging may not be so favorable.

A fruitful source of error is in supposing that the ordinary channels of transportation cannot be relied upon as a clue to the gross product of the mines. It is alleged that large quantities of the precious metals are carried away in the pockets of the miners. Even if this were so, it is not reasonable to suppose that the miners continue to burden themselves with their treasure after arriving at their place of destination. It must find its way into the mint or branch mints for coinage or the custom-house manifests for exportation. It cannot be assayed without paying its internal revenue tax. The gross yield of all the mines can be determined with approximate accuracy. It is more difficult to arrive at a subdivision, when it comes to the product of each State and Territory. In California, for example, during the early days of placer mining, before the transportation of bullion by organized companies had become a business entitled to confidence, a large proportion of the gold derived from the mines was carried out of the country by private hands. There was comparatively little danger of loss. The routes to San Francisco were short, public, and protected by general interest. From that point to New York the passengers usually combined for mutual protection, and the risk was inconsiderable. It was not until the idle and the profligate began to obtain an ascendency, the business of transportation by express more firmly established, and the mines more difficult to work with profit, that the increase of risks and reduction of charges resulted in the general abandonment of this system. It doubtless prevails to a limited extent now, but the transportation of bullion by private hands in California is exceptional. It probably does not exceed seven per cent. in the aggregate, and this applies only to the routes by which it reaches San Francisco. In reference to silver it is impossible that any considerable amount can escape notice in this way. The yield of Nevada can be determined with more accuracy than that of other States. Silver predominates in the mines; and where gold is obtained it is not in an uncombined form. When we come to Montana, Idaho, Washington, and Oregon the greatest difficulty is experienced.

Shipments of treasure from Montana and Idaho may become incorporated with others before reaching their destination. From Montana most of the bullion goes east. Two main routes are open to examination—one by the Missouri river, the other by Salt Lake City. Indian disturbances and the insecurity of the roads have during the past year almost entirely closed the latter; so that the chief exit is by the former route. Shipments from Idaho are made chiefly by way of Portland and the inland stage route through Humboldt and across the Sierra Nevada. On both of these routes it is alleged that they are liable to become merged with the products of other States and Territories. It has been impossible to obtain an account of the shipments from each agency at the express office of Wells, Fargo & Co., at San Francisco. For reasons of private expediency they refrain from giving the desired information. We have, however, the aggregate receipts at their office, and knowing very nearly what amount can fairly be credited to California, Nevada, and British Columbia, can draw reasonable conclusions as to the proportion derived from Idaho, Washington, and Oregon. From the best information available the following is a near approximation to the total gold and silver product for the year ending January 1, 1867:

California	$25,000,000
Nevada	20,000,000
Montana	12,000,000
Idaho	6,500,000
Washington	1,000,000
Oregon	2,000,000
Colorado	2,500,000
New Mexico	500,000
Arizona	500,000
	70,000,000
Add for bullion derived from unknown sources within our States and Territories, unaccounted for by assessors and express companies, &c.	5,000,000
Total product of the United States	75,000,000

The bullion product of Washington is estimated by the surveyor general at $1,500,000. That of Oregon is rated as high as $2,500,000. Intelligent residents of Idaho and Montana represent that the figures given in the above estimate, so far as these Territories are concerned, are entirely too low, and might be doubled without exceeding the truth. The product of Idaho alone for this year is said to be from $15,000,000 to $18,000,000. That of Montana is estimated by the surveyor general at $20,000,000. Similar exceptions are taken to the estimates of Colorado, New Mexico, and Arizona. As I have no grounds for accepting these statements beyond the assertion that most of the bullion is carried away in the pockets of the miners, I am inclined to rely upon the returns of the assessors, express companies, and official tables of export. Admitting that a fraction over seven per cent. may have escaped notice, although reasonable allowance is made for this in the estimate of $70,000,000, and that a considerable sum may be derived from sources not enumerated, I feel confident the additional allowance of $5,000,000 is sufficient to cover the entire bullion product of the United States for the year 1867, thus making the aggregate from all sources $75,000,000, as stated in the report of the Secretary of the Treasury.

I have endeavored to obtain returns of the annual product of each State and Territory since 1848; but, for the reasons already stated, and in the absence of reliable statistics, it has been impossible to make the necessary divisions with more than approximate accuracy. As nearly as I can judge from the imperfect returns available, the following, in round numbers, is not far from the total product:

California	$900,000,000
Nevada	90,000,000
Montana	65,000,000
Idaho	45,000,000
Washington	10,000,000
Oregon	20,000,000
Colorado	25,000,000
New Mexico and Arizona	5,000,000
In jewelry, plate, spoons, &c., and retained for circulation on Pacific coast	45,000,000
	1,205,000,000
Add for amounts buried or concealed and amounts from unenumerated sources, and of which no account may have been taken	50,000,000
	1,255,000,000

This statement requires explanation. Up to 1855 a considerable portion of the gold taken from California was not manifested. In 1849 the actual yield was probably $10,000,000; in 1850, $35,000,000; in 1851, $46,000,000; in 1852, $50,000,000; in 1853, $60,000,000; and in 1854, $53,000,000. The amount unaccounted for by manifest was not so great after the last date. In 1861 Nevada and Idaho commenced adding their treasure to the shipments, so that after that date a deduction for the amounts produced from these sources would be necessary, if the manifest alone were taken as a criterion, in order to arrive at the product of California.

An addition should be made for the amount retained for currency, estimated by some as high as $45,000,000, but probably not exceeding $35,000,000 or $40,000,000; and for plate, jewelry, &c., of California gold, say $2,000,000, and Nevada silver, $3,000,000.

Incorporated in these shipments are the amounts received from Nevada, Idaho, Oregon, Arizona, Washington, and British Columbia; but these cannot be deducted from the manifest of exports, according to the express returns, since the proportions are not accurately known of the amounts, retained and shipped, derived from separate sources.

The general condition of the mining interest on the Pacific slope is encouraging. There have been fewer individual losses than during past years, and the yield of the mines has been comparatively steady and reliable.

Fluctuations in mining stock have not been so great as usual, and those wild and injurious speculations which have impaired confidence in this great interest are gradually becoming narrowed down to individual operators, whose influence in the community is limited.

Legitimate mining has been as prosperous as other pursuits, though it cannot be denied that there are uncertainties attached to this peculiar business which render it hazardous and require more than ordinary profits to make it remunerative under the most favorable circumstances. It may seem strange in this view that the gross product of bullion has been gradually diminishing for some years past, but a brief reference to the history of mining operations on the Pacific coast will explain this apparent anomaly.

The existence of gold in California was known long before the acquisition of that territory by the United States. Placers had long been worked on a limited scale by the Indians; but the priests who had established the missionary settlements, knowing that a dissemination of the discoveries thus made would frustrate their plans for the conversion of the aboriginal races, discouraged by all means in their power the prosecution of this pursuit, and in some instances suppressed it by force. As early as December, 1843, however, Manuel Castanares, a Mexican officer, made strenuous efforts to arouse the attention of the Mexican government to the importance of this great interest.

It is not my purpose to enter into a detail of the events preceding the discovery by Marshall on the 19th of January, 1848, or the subsequent excitement which resulted in the opening of the great placer mines, and the rush of immigration in 1849. Reference is made to these incidents in the history of California merely to show the changes in the character of the business. At first gold was easily found, and required but little skill in separating it from the loose gravel or sand in which it was imbedded. Frequently it lay so near the surface in such quantities and in grains of such form and size, that a simple pan or rocker comprised all the means necessary, with ordinary labor, to insure extraordinary profits. Mere will and muscle were sufficient. Our people were inexperienced, but ingenious in devices for saving labor, energetic and industrious.

Unskilled as they were, nearly all who went into the business realized handsome profits; and the reports of their success induced a rapid immigration from the Atlantic States, South America, Australia, and other parts of the world.

Thus towns were built up; a new and extensive commerce sprang into existence;

lands were cultivated to supply the miners; roads were cut through the difficult passes of the mountains; steamboat and stage lines were established; and the country from the western slopes of the Sierra Nevadas to the shores of the Pacific, for many hundred miles north and south, became suddenly filled with an industrious, intelligent and enterprising population. Even in those early days, however, as the surface placers receded towards their sources, time and money were expended in the rediscovery of inventions which had been known to the old world for centuries.

With all the genius and enterprise of the American people, no important discovery in the way of machinery for mining was made which had not been long in use in South America, Mexico, or Europe. The same necessities gave rise to identical contrivances for saving labor, and it is sufficiently creditable to our miners to say that without any knowledge of what others had done, they frequently improved upon the originals. The fact demonstrates very clearly that want of knowledge, even in the preliminary stages of mining, is a source of loss. When the precious metals are easily obtained, and the profits of individual labor are large, less injury results from ignorance than in the subsequent stages of the business, when capital is required and the process of reduction is more complicated. Mining differs essentially from every other branch of industry. Unlike agriculture, there is but one crop in a mine. As the work progresses the stock of mineral is decreased, and can never be replenished by any human art. There is no opportunity of recovering what has been lost or wasted.

The farmer changes his crop or his system of cultivation; and his land can be improved and his profits increased by experience. So also in manufactures and other pursuits. Hence it is important that the experience of mankind should be preserved so that error may be avoided.

Comparatively little progress was made in vein or quartz mining prior to 1860. Quartz veins containing the precious metals were discovered in California in 1850, and for several years experiments were made in working them, generally with loss. The Mexicans with their arastras were the only successful quartz miners. Experience in their own country enabled them to realize fair profits upon their labors. Their system of mining, however, was too slow for an American population, to whom large investments of capital were of no consequence, provided there was a prospect of immediate and abundant returns.

The discovery and development of the Comstock lode in Nevada gave the first impulse to this kind of mining. The wonderful richness of that vein attracted attention at once, and drew from all parts of the world men of scientific attainments. By the developments made in working it, the principle was established that quartz veins could be rendered a profitable source of supply on the Pacific coast. The experience thus gained impelled the adventurous miners of California to attempt new systems, and devote themselves with greater vigor to the opening and working of the gold-bearing veins in that State.

In 1860 the product from this source in California did not exceed $2,000,000. As the surface diggings gave out, a resort to vein mining became indispensable. The proportion of bullion now derived from various sources within the limits of the State is about as follows: from surface diggings, $2,000,000; from cement or deep-lying placers, $18,000,000; from quartz mines, $9,000,000—total, $25,000,000.

Professor Ashburner estimates that about 80 per cent. of the gold is produced from the mines lying north of the Mokelumne. The production of the southern mines is diminishing every year, and the surface diggings will soon be exhausted. Wherever the latter predominated a sudden but ephemeral prosperity was engendered. General stagnation now prevails; towns are depopulated; real estate is of little value; business is depressed. The population consists of hundreds in many counties where it formerly consisted of thousands. Reference to the accompanying reports will show the present condition of these localities. Good quartz veins exist in many of them, but the want of capital has retarded their development. Unskilled labor can make no further progress, and new fields of enterprise have been sought by those who formerly depended upon the placers. Some have pushed their way over the mountains into Idaho, Montana, and other new Territories; others have given up mining and devoted themselves to farming, trade, or commerce.

Similar changes have been experienced in Idaho, Montana, and other Territories in which surface mining attracted a population. At first the yield was large and easily obtained; as the surface deposits were worked up to their sources quartz veins were discovered, and machinery and skill became requisite; the difficulty of access to the more remote mineral regions increased the expense of transportation, and the uncertainty of remunerative results impaired confidence. History shows that these changes occur in all mining countries and are inseparable from this branch of industry.

No uneasiness need be felt as to a decrease in the source of supply. After many years of travel over the mining regions, I feel justified in asserting that our mineral resources are practically without limit. Explorations made by competent parties during the past year in many parts of the mineral region hitherto unknown demonstrate the fact that the area of the mineral deposit is much larger than was ever before supposed. It is safe to assume that of the claims already recorded in the settled parts of the country, and known to be valuable, not more than one in a hundred is being worked; and of those worked perhaps not more than one in fifty pays anything over expenses, owing to mismanagement, inefficient systems of reducing the ores, want of capital, cost of transportation, and other causes susceptible of remedy. In many districts of Nevada silver ores of less value than $100 a ton cannot be worked by mill process so as to pay expenses; and there are districts in Idaho and Montana where gold-bearing ores will not justify working unless they yield from $40 to $50 per ton.

With such wealth of treasure lying dormant, it cannot be doubted that, by the increased facilities for transportation and access to the mines soon to be furnished by the Pacific railroad and its proposed branches, and the experience in the treatment of ores, and the scientific knowledge to be acquired in a national school of mines adequate to the necessities of the mining population, the yield must eventually increase.

The adventurous Americans who take the lead in the development of these frontier regions are generally energetic and intelligent, but prone to extravagance and reckless speculations.

No country in the world can show such wasteful systems of mining as prevail in ours. At a moderate calculation, there has been an unnecessary loss of precious metals since the discovery of our mines of more than $300,000,000, scarcely a fraction of which can ever be recovered. This is a serious consideration. The question arises whether it is not the duty of government to prevent, as far as may be consistent with individual rights, this waste of a common heritage, in which not only ourselves but our posterity are interested.

The miner has a right to the product of his labor, but has he a right to deprive others of the benefits to be derived from the treasures of the earth, placed there for the common good? The precious metals are of an imperishable nature, evidently designed to pass beyond the reach of the discoverer and to subserve purposes of human convenience for generations. Our children have an interest in them which we cannot with propriety disregard.

The bill to establish a national school of mines, introduced in the Senate, at the beginning of the present session of Congress, by Mr. Stewart of Nevada, is designed to remedy this evil. Similar schools have been established in various parts of Europe, and the best evidence of their utility is the fact that we are indebted to them for nearly all the knowledge we possess on the subject of mining and metallurgy. Our mines and mills are practically managed by foreign experts; we furnish the labor and mechanical ingenuity, but they furnish the scientific skill. Without the aid of foreign institutions we could have made but little progress in mining; and yet we lose much by not having similar institutions in our own country. The local circumstances existing in Europe differ essentially from those which prevail in the United States. It would be a great advantage, not only in the saving of expense, but in the more direct availability of the experience gained, if our young men could learn at home what they are now compelled to learn abroad.

The plan proposed by Mr. Stewart's bill seems both feasible and economical. Such an institution would, if properly conducted, result in a large annual increase in our bullion product. It is not unreasonable to anticipate that, instead of declining within a few years to forty or fifty millions per annum, as will undoubtedly be the case if the present state of things continues, there would be an increase amounting to at least 100 per cent. on the yield of the mines for the past year. I venture the hope, therefore, that Congress will take this proposition into favorable consideration. The bill, as amended by the Committee on Mines and Mining, of the Senate, and the considerations upon which it is based will be found in the appendix, (A.)

It is proper that I should give due credit to my assistants for the part which they have taken in this work. The duty of collecting statistics in California was intrusted to Mr. John S. Hittell, the able and experienced author of several valuable works on the industrial resources of that State. In the performance of the special service assigned to him he visited the principal mining districts. His reports are based upon actual observation, and may be relied upon as accurate and impartial. With the exception of the report on Nevada county, by Mr. E. F. Bean, the county assessor, and Mr. H. Rolfe, his assistant, and the brief reports on some of the northern and southern counties by Dr. Henry Degroot, with a sketch of the Morris Ravine mines by Dr. A. Blatchley, nearly all the gold-bearing regions of California are described by Mr. Hittell. Important papers on the condition of the mining interest in Mexico, South America, Australia, &c., are also furnished by the same authority.

An elaborate and interesting report on the miscellaneous minerals of the Pacific States and Territories is furnished by Mr. Henry C. Bennet, a mining engineer familiar with the subject. No such complete and extended notice of the miscellaneous mineral productions of the Pacific coast has yet been published. This report will be found valuable to business men, and to all others seeking information respecting the resources of the States and Territories west of the Rocky mountains.

To Mr. R. H. Stretch, late State mineralogist of Nevada, the Comstock lode and regions adjacent were intrusted. His scientific and practical knowledge of the various departments of mining, his long experience in this particular region, and his known integrity, rendered the selection peculiarly fortunate, as will be conceded upon a perusal of his report.

Dr. Henry Degroot, a statistician and writer, whom I deputed to travel through Nevada, has furnished a series of interesting papers on the miscellaneous resources of that State.

Mr. Myron Angel, of Austin, a gentleman well acquainted with eastern Nevada, contributes a report on that region, from which it will be seen that the mineral wealth of Nevada is by no means confined to the Comstock lode.

The services of Dr. A. Blatchley, a mineralogist and mining engineer, were secured for an exploration of Montana and Idaho. This gentleman travelled through those Territories during the months of June, July, and August, and was enabled to collect the information which is embodied in his reports.

Mr. Elwood Evans, of Olympia, formerly territorial secretary of Washington, has kindly furnished detailed reports on the resources of that Territory.

To Mr. Ainsworth, Mr. Hill, Mr. Ladd, and others, I am indebted for information relative to the trade and resources of Oregon.

The report on Arizona is from the pen of Governor R. C. McCormick. It will be found extremely interesting.

Mr. W. M. Gabb, of the State geological survey of California, whose recent expedition through Lower California has attracted considerable attention, contributes a detailed report on the mineral resources of that peninsula. It is the result of the first scientific exploration ever made of that region, and possesses a peculiar interest at this time, owing to the investment of American capital there and the purchase from the Mexican government of an extensive grant by private parties for colonization by Americans.

Many other prominent and experienced gentlemen have assisted me in the preparation of this report. I claim little more for myself than the direction and supervision of the work; it has occupied my entire time for upwards of a year, and, whatever may be its imperfections, few will be disposed to deny that it presents evidence of an earnest attempt to carry into effect the wishes of the department and the objects designed to be accomplished by Congress.

It is a common error to suppose that mining is inimical to the welfare of the people. No branch of industry requiring mechanical skill and the acquisition of scientific knowledge can justly be said to contain in itself elements injurious to public morals or to the prosperity of the state.

The tendency of this pursuit is, at first, to attract a reckless and adventurous population, whose disregard of conventional restraint leads to the assumption of risks and to bold and hazardous undertakings, by which new countries are most rapidly opened up to settlement and civilization. Providence so ordains it that the superficial treasures of the earth designed to attract this enterprising class soon disappear, and a higher order of intelligence is required and a more permanent condition of things is established. It is only necessary to look back over the past eighteen years to find in the advancement of the vast region known as the Pacific slope, the strongest possible refutation of the assertion that mining is inimical to the welfare of the people. Looking forward to the future, who can predict the high condition of prosperity likely to be attained by these new States and Territories eighteen years hence?—with trans-continental railroads and telegraph lines binding the Atlantic to the Pacific; with branch roads and lines traversing the country north and south; with the commerce of Asia pouring its treasures into our seaports; with an export trade commanding the whole eastern world; with a probable coast line stretching from Behring Straits to Cape St. Lucas; with innumerable flourishing cities and seaport towns; with an agricultural population numbering thousands where they now number hundreds; with busy manufactories scattered over the land; with churches, schools, and colleges everywhere throughout the mountains and valleys—All these many of us may live to see, but few can now realize the magnificent future that lies before us. In this favored land the laborer, the artisan, the mechanic, the man of science, can each find profitable employment and a congenial home. As we want population to develop the dormant wealth of our new States and Territories, it is the interest of our government to disseminate a correct knowledge of their material resources.

Entertaining these views, I trust the report herewith submitted will not be without practical utility wherever it may be circulated.

Very respectfully, your obedient servant,

J. ROSS BROWNE.

Hon. H. McCulloch,
Secretary of the Treasury.

CALIFORNIA.

SECTION I.

GENERAL CONDITION OF THE MINING INTEREST.

The information and statistics relative to the gold mines of California were collected between the 17th May and the 25th July, but some interesting changes have occurred since the tour of inquiry was made, and the facts, when ascertained, have been mentioned. Many of the figures and data could be obtained only from the mine owners, who may sometimes have misrepresented the character and yield of their claims in a favorable light for the purpose of selling, or in an unfavorable light for the purpose of misleading the assessor and tax-collector. It is believed, however, that the statements as made are generally true, and it is hoped that, taken together, they will be found to be the fullest and most correct collection of important facts ever made relative to gold mining.

The general condition of gold mining in California is that of decline. The amount of production becomes smaller every year, but the decrease is confined chiefly to the placer yield. In quartz more work is being done; it is being done better than ever before, and there are more mines in successful operation. The business is flourishing and improving, with a fair prospect of continuous increase; and the success of many of the mines is most brilliant.

In 1864 Professor Ashburner wrote a report on the Mariposa estate, and in it he made the following general remarks:

> In 1858 there were upwards of 280 quartz mills in California, each one of which was supplied with quartz from one or more veins. The number of stamps in these mills was 2,610, and the total cost of the whole mill property of this nature in the State exceeded $3,000,000. In the summer of 1861, while I was attached to the geological survey, I made a careful and thorough examination of all the quartz mills and mines of the State, and could only find between 40 and 50 in successful operation, several of which were at that time leading a very precarious existence.

Many of those old enterprises have not yet become, and never will become, profitable; but of the quartz mills built within the last four or five years, the successful proportion is much larger than before 1860. No business offers greater facilities to ignorance and folly for losing money; and, unfortunately, most of those who engaged in it had no experience and were led by their presumption into gross blunders in both mining and milling.

The greatest common blunder in quartz mining, and the most common error in early times as well as in our own day, has been that of erecting a mill before the vein was well opened and its capacity to yield a large supply of good rock established. The commission of this blunder is proof conclusive of the utter incompetency of its author to have charge of any important mining enterprise. If there were any possibility that it should in some cases lead to considerable profit, there might be an excuse for it, but there is none. It never pays. All the chances, including that of utter failure, are against it.

The next blunder was that the difference between a pocket vein and a charge vein was not understood, and the existence of rich specimens was considered proof of the high value of a mine, whereas among experienced quartz miners it excites their suspicions and distrust. Nine-tenths of the lodes which yield rich specimens do not pay for milling. West Point, in Calaveras, and Bald Mountain, in Tuolumne, the richest pocket districts of the State, are not to be compared for yield with Sutter creek or the Sierra Buttes, where there is scarcely a passable specimen in a thousand tons.

The next error was that nothing was known of pay chimneys, and if good quartz was found in one place, it was presumed that the whole mine was of the same quality. In some cases the pay chimney was near the end of a claim, into which it dipped not far from the surface, leaving the mill without rock. In other cases the miner had his pay chimney in his own claim, but he did not know enough to follow it, and he worked straight down into barren rock, while there was an abundant supply of good quartz higher up.

Another error was that of sinking when nothing was found at the surface; a policy that may do in mining for other metals, but is very risky in gold. If the croppings are barren along a considerable distance, deep sinkings will rarely pay; but if the vein does not crop out, the only way to examine it may be by a shaft.

Much rock has been crushed without examination and without any proper selection.

In the mortars it is a common mistake to use too much quicksilver and too much water.

It has not been customary to make assays regularly of the tailings, so as to know what was passing off.

The mine owners, in a large proportion of the cases, have not resided at the mines, and have not made a study of the business; and no occupation requires personal supervision and thorough knowledge on the part of the owner more than mining.

These blunders are gradually being corrected, and if they were not still quite common the quartz mines of California would yield nearly twice as much as they do. The business will never be established upon a proper basis until the superintendents as a class are well-educated chemists and mining and mechanical engineers, and the mine owners frequent visitors, if not regular residents, at the mines.

In placer mining there is not room for much improvement. All the processes are simpler, and the work has generally been done well.

The southern mines—that is, in the counties of Amador, Calaveras, Tuolumne, and Mariposa—have nearly exhausted their placers. They had few deep gravel deposits, and in all four there has not been one large hydraulic claim such as abound north of El Dorado. Placer, Yuba, Nevada, Sierra, and Plumas are more prosperous than the counties further south, mainly because of their extensive beds of auriferous gravel more than a hundred feet deep.

THE ACT OF JULY 26, 1866.—Few applications have been made for the purchase of quartz mines or of agricultural lands in the mineral districts, under the act of July 26, 1866, "granting the right of way to ditch and canal owners over the public lands, and for other purposes."

The farmers of the mining districts have long been anxious to get titles, but the value of their possessions has decreased considerably of late, and many of them do not feel able to pay for the expense of a survey. They are required to pay not the survey of their respective farms alone, but for the survey of all the agricultural land in the whole township in which they are situated, and in some cases this expense may be $400. If several unite, the cost is less to each; but the whole expense comes upon the first application, whether made by one or many. After the survey has once been made, applicants have no expense save the price of the land and a few small incidentals. Previous to the first of June twenty-five farmers in Tuolumne and Stanislaus counties had expressed a desire to get patents, and all would undoubtedly have taken them if the survey had not stood in the way. The public sentiment of the State is unanimously in favor of the sale of these agricultural lands.

The surveys of quartz mines are not so expensive as those of agricultural claims, because it is not necessary to survey the whole township for a mine claim, but only to connect it with the public surveys by some one line, so that it can be laid down accurately upon the map. The expense depends upon circumstances, but it will seldom exceed $100 for every step from the beginning until the issue of the patent, exclusive of the time and travel of the surveyor in getting to the place where the mine is situated.

The owners of quartz mines generally desire to get patents, but the fact that the claims on public lands are not taxed, and that those which have been granted by the government are taxed, is a strong objection. The tax in the mining counties varies from three to four and a half per cent. annually, and that is a serious consideration with many.

The revenue law of California says:

> All property, of every kind and nature whatever, within this State shall be subject to taxation, except * * * mining claims. (*Hittell's General Laws, article* 6298.)

A supplementary act says:

> All provisions of law exempting mining claims from taxation are hereby repealed so far as they apply to lands or mines in the condition of private property, and granted as such by the Spanish or Mexican government, or the government of the United States, or of this State. (*The same, article* 6265. *Instructions under the act of July* 26, 1866.)

The instructions issued by the Commissioner of the General Land Office to the surveyor general of California, and by him to his deputies, are worthy of being placed within their reach, and will be found in the appendix.

SURVEYS.—Up to the 10th of October, 1867, eleven surveys, made under applications for patents of lode mines, have been received at the United States surveyor general's office in San Francisco. These eleven are the Peñon Blanco, Virginia, Jones, Potts, and Oakes & Reese, (these two last adjoin, and may be considered as parts of the same mine, though on different veins,) in Mariposa county; the Trio, McCann, Arbona, Hitchcock, and Grey Eagle, in Tuolumne county; and the Kelsey, in Eldorado county. Applications for surveys for patents have been made in many other cases, probably fifty, at least, and notices of the applications have been advertised in the newspapers in the mining counties, but the surveys have not yet reached the surveyor general.

The State has been divided into nine districts, with a deputy surveyor in each. The following are the districts:

First district.—Del Norte, Klamath, and Humboldt counties.
Second district.—Siskiyou, Shasta, and Trinity counties.
Third district.—Plumas, Butte, and Sierra.
Fourth district.—Yuba and Nevada.
Fifth district.—Placer, El Dorado, and Sacramento.
Sixth district.—Amador.
Seventh district.—Alpine, Mono, and Inyo.
Eighth district.—Tuolumne, Mariposa, Stanislaus, Merced, Fresno, and Calaveras.
Ninth district.—Los Angeles, San Bernardino, Kern, San Diego, and Tulare.

SECTION II.

THE MOTHER LODE.

The mother lode is in many respects the most remarkable metalliferous vein in the world. Others have produced and are producing more, but no other has been traced so far, has so many peculiar features, has exercised so much influence on the topography of the country about it, or has been worked with a profit in so many places. The great argentiferous lodes of Mexico and South America, the most productive of precious metal of all known in history, can be followed not more than six or eight miles; while this Californian vein is distinctly traceable on the surface from Mariposa to the town of Amador, a distance of more than 60 miles.

COURSE AND DIP.—The general course of the vein is very nearly northwest and southeast, but to be more precise it is north 40° west. If a straight line be drawn on the map from Mariposa to Amador, the mother lode will be in several places two or three miles distant from the line, but usually within half a mile of it.

The dip is always to the eastward, and usually at an angle of 45° or 50° to the horizon.

CHARACTER OF THE GOLD.—The gold is generally in fine particles, and is distributed evenly through a large portion of the lode in the pay chimneys, and there is very little of the rock entirely without gold. The sulphurets are not very abundant nor very rich, and when found they consist almost exclusively of pyrites of iron and copper, without those mixtures of lead, arsenic, antimony, and zinc which interfere with amalgamation seriously in some other lodes. The quartz of the mother lode is usually hard and white; and in most of the pay chutes near one wall or the other, ribbon rock, or rock with numerous black seams lying parallel with the wall, is found. In some mines, especially at the Raw Hide, the quartz is colored green with carbonate of copper; and the same color, though not so strong, is observed in portions of the Princeton mine.

WIDTH.—The width varies from a foot to thirty feet; that is, the main vein as worked; but it is accompanied by branches or companion veins, so that the total width of vein matter is sometimes nearly a hundred feet. In some places these side veins are known to be branches separated at the surface from the main vein by "horses;" in others they are different in material and do not unite at the deepest workings. The most remarkable side veins are those of talcose slate, which in some places can be traced for miles. They are from two to twenty feet wide, and are rich in gold. We do not find, in our books, mention of any similar auriferous deposit in other countries; but in California a number of them have been found, remote from the mother lode as well as near it.

South of Maxwell's creek is a parallel talcose vein, on the west side of the main mother lode, known as the Adelaide, which name was given to it by Mr. J. F. Johnson. The same name has been given by mistake in Tuolumne county to a companion talcose vein on the east side of the main lode. There is no reason that the two are the same vein, or for extending the name of one to the other.

PAY CHIMNEYS.—The pay chimneys are usually large and regular, and are either vertical or have a slight dip to the north.

In the companion talcose veins the pay chimneys are not distinctly marked, nor are the character and limit of the lode well defined.

HILLS AND HOLLOWS.—The streams seem to have made their beds in places where the mother lode is split up into a number of branches, as at the Mercede, Maxwell's creek, Tuolumne, Stanislaus, and Mokelumne rivers; while in those places where the lode is wide and solid there are high hills, as at Peñon Blanco, Pine Tree, Whiskey Hill, Quartz Mountain, and Carson Hill. The richest part of the vein was on the top of Carson Hill, and next to that in richness was Pine Tree Hill. The Hayward, the Oneida, and the Keystone are in valleys. The Golden Rule and the mines at Angels are neither on hill nor in hollow, and are yet very rich.

No other class of quartz mines in California is so poor in specimens as those on the mother lode, nor, with two or three exceptions, are there any others in which the gold is so regularly distributed through the pay chutes.

PECULIARITIES OF THE LODE.—The chief peculiarities of the mother lode are its great length, its great thickness, its uniform character, the near proximity of large companion veins, of which at least one is usually talcose, and the richness of the talcose veins. In reply to questions about the chief distinguishing feature of the mother lode, the miners engaged in working various mines gave very different answers. One said it was the presence of a belt of green stone on the eastern side. Another thought it was a black putty gouge. A third spoke first of the occurrence of places as smooth as glass on the walls. Another considered the mother lode to consist of two branches, one the luminated, the other the boulder branch. The former is usually on the west side; the latter has the most curves. The lode is richest where the two meet. Another says the mother lode is a series of branches, sometimes a dozen in number, covering a width that varies from 500 to 3,000 feet, with a greenstone porphyry wall on the east, and dioritic porphyry wall on the west.

IS IT A FISSURE VEIN?—The question whether the mother lode is a gash or a fissure vein has little practical importance. Such an inquiry is serviceable in regard to deposits the character of which is doubtful; but we already know that in regard to length, uniformity of veinstone, continuity in depth, and number of pay chutes, few fissure veins exceed this. Professor Ashburner, in a report made on the Pine Tree and Josephine mines, in May, 1864, expressed an opinion that the "great majority" of the auriferous quartz lodes of California are gash veins; and he implies that the Pine Tree, which is a part of the mother lode, belongs to that class. Whitney, in his "*Metallic Wealth of the United States*," says:

> True fissure veins are continuous in depth, and their metalliferous contents have not been found to be exhausted or to have sensibly and permanently decreased at any depth which has yet been obtained by mining.
>
> Segregated and gash veins, and the irregular deposits of ore not included under the head of veins, and not occurring in masses as part of the formation, cannot be depended upon as persistent, and they generally thin out and disappear at a not inconsiderable depth; at the same time they are often richer for a certain distance, and contain larger accumulations of ore than true veins, so that they may be worked for a considerable time with greater profit than these, although not to be considered as of the same permanent value.

In a report on the Princeton mine made by Professor Blake, in December, 1864, he said:

> The identification of the Princeton as a fissure vein leads us to the question whether all the gold veins of the Sierra Nevada and other gold districts of similar formation are not also of fissure origin, rather than formed by metamorphism from materials pre-existing in the strata. It certainly is not essential to a fissure vein that it should cut across the strata of a country. In a region of regularly stratified slates, the line of least resistance to a breaking force is certainly the line or plane rather of the stratification. In that line or plane the rocky crust may be most readily split, and hence it is, I believe, that most of our veins are found conforming to the stratification. Professor Tuomey, in his report on the geology of South Carolina, describing the gold-bearing veins of that State, mentions several that for a part of their course follow the bedding of the rocks, and in other places cut across the bedding. I have observed similar conditions at various places in California, and I am daily more and more inclined to the view that gold veins are the results of emanations from great depths below, which, ascending through rifts and fissures of the rocks, were condensed or deposited upon the walls.

CLAIMS IN MARIPOSA.—The following is a list of the claims on the mother lode, beginning at the mother lode and going northward:

The Crown Lead, 4,500 feet on the mother lode, besides claims on two parallel lodes. Not at work. Noticed elsewhere.

The Virginia, 2,500 feet, crops out largely. A tunnel 160 feet long strikes the vein at a depth of 100 feet. Several shallow shafts have been sunk. Some good quartz has been found, but no work is being done now. There is no mill.

The Pyles, 1,200 feet; no work done.

The Mary Harrison has a mill, and is at work.

The Clayton, 3,000 feet.

The Louisa, 3,000 feet, is being opened and explored. One shaft is down 130 feet, and another is being sunk to the same depth, and a third, commenced on a lower level, is down 90 feet. A tunnel started near the level of Maxwell's creek, strikes the bottom of the 90 foot shaft. About 2,000 tons of ore have been taken out, and have been crushed at the mill of the Maxwell Creek Mining Company, yielding $8 or $9 per ton. The mother is split up here into a number of branches.

On the Margaret, 3,000 feet, no work has been done. In this claim the mother lode is split up into a number of narrow branches, at least at and near Maxwell's creek, which separates it from the Louisa.

The Pumpkin, 3,000 feet, is not doing anything. Several shafts have been sunk, and some rock taken from it seven or eight years ago yielded $40 per ton.

The Nonsuch, 1,400 feet, is lying idle.

Parallel with and opposite to the Nonsuch, 300 feet distant to the eastward, on a talcose slate vein, is the Hidely and Cunningham mine. A four-stamp mill commenced running last spring.

On the King Solomon, 3,000 feet, no work is doing.

The Yosemite, 3,000 feet, has a tunnel of exploration, but no mill, and is not at work.

The Peñon Blanco, 6,000 feet long, is being explored by a tunnel running 285 feet on the vein from the northwest side of the hill, and by a cross-tunnel from the east side of the hill. Eight men are at work, and $6,000 or $8,000 have been spent on the claim. The name is Spanish, means "large white rock," and was suggested by the immense croppings of white quartz on the top of the high hill, which is one of the most prominent land-marks in the western part of Mariposa county.

The Murphy, —— feet, has done nothing.

The McAlpin, 1,200 feet, was worked 10 years, first with an arrastra, and afterwards with an eight-stamp. The lode is here 25 feet wide. A tunnel strikes the vein 400 feet below the surface, and a shaft runs down 160 feet from the tunnel. McAlpin sold out in 1864, and left the State, taking with him, if rumor is right, $75,000 obtained net from the mine. Since he left the mine has not paid, and the mill is now standing idle. Ten or 15 feet eastward from the main lode, and parallel with it, is a companion vein, which has been worked to some extent, and is supposed by some miners to be richer than the main lode. The mill is driven by water supplied by the Golden Rock Water Company.

CLAIMS IN TUOLUMNE.—The following claims are now lying idle or only partially worked. Those marked * are idle; those upon which work is being done are noticed:

The King Philip*; the Newhall,* 3,000 feet; the Rhodes,* 3,000 feet; Woodworth,* 3,000 feet; Wheeler,* 7,500 feet; Munn*; Wotcott and Rocco*; the Culbertson,* extending across the Tuolumne river; here comes a tract* of 1,200 feet in dispute; the Kelly,* 4,000 feet; the Clio, 2,000 feet, has a 10-stamp mill, not at work now; the Scorpion*; the Northern Light,* 3,000 feet; the Johnson, the Yuma,* 3,150 feet, and the Hector, are on the Talcose companion vein in this neighborhood. The Shawmut is on the main lode and has a mill. The Eagle also has a mill.

The Chickenhawk has two shafts, and is at work with a hoisting engine, but without a mill. The Dickson & Co.,* 1,500 feet; the Durgan & Co.,* 500 or 600 feet; the Golden Rule*; the Simmons & Co.,* 800 feet; the Miller, Waller & Co.,* 450 feet; the Heslep & Co.,* 900 feet; the Simon Whitford & Co.,* 450 feet; the Rowe & Co.,* 350 feet; the Golden Rule, 1,600 feet, has a 15-stamp mill in profitable operation on the eastern vein; the Waller & App,* 780 feet, has a shaft 60 feet deep; the Hitchcock,* 500 feet. The Nyman, 550 feet, has a tunnel 150 feet long, and a shaft 40 feet deep; another tunnel is now being run to open the mine. There is no mill.

The Jim Stuart,* 530 feet, has a shaft 78 feet deep; the App, 1,000 feet, has been worked regularly for seven years with a 10-stamp mill. Opposite to the App, on the eastern talcose vein, is the Heslep, 1,650 feet, which has been at work for 15 years with a 10-stamp mill. This claim extends beyond the App and is opposite the Jim Stuart also.

The Silver, 1,500 feet, has a 10-stamp mill, but in May all the work was given to opening the mine. The Sweeny, 1,500 feet, has a five-stamp mill, but the mine has caved in, the flume was blown down, and no work is being done. One pocket near the surface paid $30,000.

The Tazewell,* 800 feet; the Donovan & Co.;* the McCann,* 600 feet; the Mooney & Co., 600 feet, has a four-stamp mill in profitable operation working the talcose vein; the Trio,* 2,316 feet, has a 10-stamp mill; the Harris, 1,000 feet, has no mill, but is being opened; the Williams & Brother, 1,000 feet, has no mill, but is being opened; the Reist, 1,000 feet, has a four-stamp mill, and is paying; the General Hooker,* 1,200 feet; the Rawhide Extension is doing nothing now, though there is a shaft 200 feet deep, which always contains water, sometimes to within 20 feet of the surface; in the Rawhide claim adjoining there is a working shaft 280 feet deep, and only 40 feet distant. The Rawhide, 1,650 feet, is owned by a New York company, and has a 20-stamp mill.

The Hensley & Co.,* 1,300 feet; the Faxon,* 1,000 feet; the Quinby, 1,000 feet, on the eastern talcose companion vein, has a four-stamp mill which has been idle for years; the Chaparral, 1,500 feet, has a five-stamp mill, but is not running; the Buckeye, 1,200 feet, is on a branch vein 200 feet west of the main mother lode, opposite to the Chaparral.

The Horsely,* 1,500 feet, has sunk a shaft 20 feet deep; the Meader & Carrington,* 1,500 feet, has a four-stamp mill; the Hawkeye,* 1,000 feet; the Silver Hill,* 1,500 feet; the Gillis,* 1,200 feet; the Gillis No. 2,* 1,200 feet; the Seavers,* 1,000 feet; the Watt*; the Alsop & Co.,* reaches to the Stanislaus river.

The following claims are on an eastern branch or companion vein of the mother lode, commencing at the Rawhide, and running northward to the Stanislaus river.

First is a piece of unclaimed ground where no lode has been found. The White Senior* claim; the Tom White,* 1,200 feet; the Patterson, has a 10-stamp mill, but only five are running; the Gillis, *1,200 feet; the Jackson;* the Waters;* the Rector,* 1,200 feet, has sunk a shaft 52 feet deep; the Watts, 1,000 feet, is now at work prospecting, about $15,000 have been taken from small veins at the surface; the Mt. Stanislaus,* 3,000 feet.

This brings us to the Stanislaus river, in the bed of which no large vein is discoverable. Here, as at Maxwell's creek, the lode is split up into a multitude of little branches.

CLAIMS IN CALAVERAS.—Immediately north of the Stanislaus river, on the line of the mother lode, Carson hill rises to an elevation of 1,600 feet above the river; and the lode in passing through the hill appears to split into three branches. On the eastern branch are the following, viz: the Virginia,* 1,000 feet; the Adjunction,* 800 feet; the Carson Hill, has done some work, but is not doing anything now; the South Carolina, 2,550 feet, has yielded $400,000, and is now closed; the Enterprise,* 800 feet; the Reserve, 980 feet, is being reopened, but has no mill, the yield has been $130,000.

These are all the claims on the eastern branch. On the middle branch are the following, commencing at the river, and running northward: the Stanislaus,* 1,200 feet; the Mineral Mountain,* 3,000 feet; the Melones,* 1,200 feet.

On the western or Santa Cruz branch is the Santa Cruz* mine, 3,000 feet; the Morgan, 500 feet, has no mill, but is at work, yielded $2,800,000 in 1850 and 1851; the Kentucky,* 220 feet; the Iron Rock, 1,300 feet, is doing nothing, though some very good rock was found in short tunnels and shafts; the Chaparral,* 3,031 feet; the Chaparral Hill, 3,200 feet, is now at work taking out rock, but has no mill.

Here comes a space where the vein has not been found.

The Hanford, 900 feet ;* the Hanford and Shears.*

Here comes an interval of a mile and three-quarters, before we reach the town of Angels.

The Stickles, 400 feet, has a 10-stamp mill at work; the Calaveras,* 1,100 feet, had a nine-stamp mill which was moved away; the Lightner, 400 feet,* had a 10-stamp mill, but it has been moved away; the Angel, 900 feet, has a 30-stamp mill, now at work; the Hill, 412 feet, has produced $250,000, and has a 12-stamp mill at work; the Bovee, 450 feet, has produced $600,000, and has a 10-stamp mill at work; the Fritz,* 600 feet, had a 10-stamp mill, which was moved away.

Here comes another space where the mother lode is not traceable on the surface, and has not been traced. The general opinion is that it crosses the Mokelumne river about three miles west of Mokelumne Hill.

CLAIMS IN AMADOR.—North of that river, in Amador county, we have the following: the Tibbetts & Corliss;* the Hayward, 1,800 feet, has 56 stamps at work, crushing 80 tons per day, and has been at work since 1852, the reputed yield is $27 per ton gross, and $22 net, or more than $600,000 net per year; the Loring Hill, 700 feet, has been worked for 10 years. Opposite to the Loring Hill, on a parallel vein, is the Railroad, 800 feet. This mine has yielded $70,000, and is now at work, but has no mill. The Wildman, 1,130 feet, is down 530 feet, and has drifted 200 feet, but the 12-stamp mill is employed in doing custom-work; the Mahoney has been working five years, with a 15-stamp mill; the Lincoln, 2,378 feet, has worked 10 or 12 years, but the 20-stamp mill is now engaged in custom-work; the Barnhart,* 1,000 feet; the Comet, 750 feet, has commenced prospecting; the Herbertville, 1,200 feet, had a 30-stamp mill, which never paid, and was burned down. No work is being done at the mine. The Keystone, has a 20-stamp mill, has worked steadily since 1851, and has produced about $700,000. Opposite to the Keystone, on a companion vein, is the Spring Hill, 1,200 feet, which has crushed 50,000 tons of quartz, but obtained little profit. It has a 30-stamp mill, which is idle, with the exception of five stamps engaged in custom-work. The Amador, 1,300 feet, was worked to a depth of 240 feet some years ago, but afterwards caved in, and has stood idle now, for some time; the Bunker Hill, 1,200 feet, is at work with an eight-stamp mill; the Mayflower,* 1,200 feet; the Hazard,* 800 feet, has an eight-stamp mill; the Pennsylvania,* 1,000 feet; the Loyal,* 600 feet, has a 20-stamp steam mill; the Italian, 340 feet, has a six-stamp mill, which has crushed about 2,000 tons; the Seaton, 1,200 feet, has a 40-stamp mill, and has worked about 10,000 tons of quartz, which averaged eight or nine dollars. The mill is not running, but the mine is being opened. The McDonald,* 800 feet; the Potosi, 800 feet, is at work with a sixteen-stamp mill; the Webster,* 600 feet, had a mill, which was moved away; the Plymouth, 1,200 feet, is being worked with a 15-stamp mill; the Enterprise, is at work with a 10-stamp mill; the Challen,* 1,000 feet; the Green Aden,* 1,200 feet, has a shaft 100 feet deep; the Hooper,* 1,200 feet; the Noe,* 800 feet; the Richmond, 800 feet, has a 10-stamp mill, but the only work now being done is prospecting.

Here we reach the Cosumnes river, and north of this the lode has not been traced distinctly, although the Pacific lode at Placerville appears to have its characteristics.

SECTION III.

MARIPOSA COUNTY.

Mariposa* county, the southernmost of the rich placer mining counties of the Sacramento basin, lies between parallels 37° and 38° of north latitude, and reaches from the summit of the Sierra Nevada to the low land of the San Joaquin valley. The northern boundary is the divide between the Tuolumne and Mercede rivers, and the southern is a line drawn northeastward from the point where the Chowchilla river strikes the plain. The only permanent stream in the county is the Merced; the so-called Mariposa river is a little brook which can readily be stepped across in the summer season.

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* The name of this county is derived from the Spanish "Las Mariposas," The Butterflies.

The distance of the town of Mariposa from Stockton is 90 miles, and the ordinary charge for freight in the summer is $25 per ton of 2,000 pounds. A stage runs to Bear Valley in a day from Stockton, and the fare is $10. Another stage line runs to Coulterville, and the fare there is $10, and the distance is made in one day. The county tax for the current fiscal year is $3 19 per $100 of taxable property. Coulterville lies north and Bear Valley south of the Mercede river, the banks of which, in that vicinity, are so steep and high that no wagon road has been made across it; and although the distance from one town to the other by the horse trail is only 10 miles, it is 45 by the wagon road.

Sectional area of Mariposa county, 1,884 square miles. Population in 1860, 6,243; estimated in 1866, 4,170. Assessed valuation of property in 1865, $1,237,370. Mr. Wm. S. Watson, constructing engineer of the projected Copperopolis and Stockton railroad says: "From the nature of the country and the pursuits of the inhabitants, Mariposa imports of merchandise 4,240 tons per annum, which, with an increase of population to the standard of Nevada county, and the consequent development of her vast resources, would be quadrupled in a very short time. The down freights from this county, consisting of copper ores, wool, hides, &c., amount to 920 tons annually. The principal points of shipping are Hornitas, Princetown, Agua Frie, Mariposa, Coulterville and Bear Valley. Total up and down freights, 5,160 tons."

The shipment of gold dust from Coulterville was $13,285 in July, 1866; $13,500 in August; $17,000 in September; $24,900 in October; $14,790 in November; $7,280 in December, $4,950 quartz and $9,484 placer in January, 1867; $11,050 placer and $14,800 in March; and $8,080 quartz and $3,660 placer in April.

The average monthly shipment of treasure from the town of Mariposa is $17,000 or $18,000.

There are two small ditches south of the Mercede river, and a branch of the Golden Rock ditch extending to Peñon Blanco, and these are the only ditches in the county. In proportion to the yield of gold, Mariposa has fewer ditches than any other county in the State.

PLACER MINING.—Many of the placer districts in the county have been very rich, but the diggings have in no place been deep, and they would long ago have been exhausted if there had been large ditches to supply water; but these were lacking, so washing has been conducted on a small scale, and for only a brief period each year. The richness of the ground and the coarseness of the gold has enabled the miners to make a profit sometimes by dry digging or scratching the gravel over with a butcher-knife. Maxwell's Creek, Blue Gulch, Bear Creek, White's Gulch, Peñon Blanco, the north fork of the Mercede, the banks of the main Mercede, and the vicinities of the towns of Mariposa and Hornitas were especially rich. In Maxwell's Creek, about 1852, the common yield was $15 or $20 per day to the man, and in 1863 two miners in two months washed out $16,000 at Peñon Blanco. In 1850 Horse Shoe Bend, on the Mercede, had a population of 400 miners. There are now a dozen small and shallow hydraulic claims there, which pay about $4 per day to the man. The population of the bend numbers 100, of whom half are Chinamen. On the top of Buckhorn mountain, east of Coulterville, at an elevation 1,500 feet above the Mercede river, there is a placer which pays well while it rains, but cannot be worked at any other time for want of water. Flyaway, in a gully by the side of Buckhorn mountain, is also rich, but there, too, no water can be got save during rains.

AGRICULTURE.—There is no agriculture in Mariposa county worthy of note. There is not one large orchard, vineyard, or grain farm. Only a small quantity of rain falls, and the soil appears to be of a very dry nature. A large portion of the surface is occupied by steep hills, which prove their thirsty character by sustaining no vegetation save the chemisal. There are no ditches to sustain irrigation, and as the most populous part of the county was the Mariposa grant, the residents there having no title had no sufficient inducement to invest money in planting trees and vines. The western part of the county is made up chiefly of chemisal hills, with occasionally small dales with scattered oak trees. In the eastern part of the county there are some plains about 3,000 feet high, and these have a rich and moist soil and may some day become far more valuable than they are now. Still farther east, at an elevation of 5,000 feet or more, we come to large forests of good pine timber, with occasional groves of the big tree.

YOSEMITE.—One of the resources of the county is the possession of the Yosemite valley, which is destined to be a favorite place of resort when access is cheaper and more comfortable than at present. The trip can now be made from San Francisco to the valley and back in eight days for $75, staying only a day in the valley, but the average amount spent on the trip by visitors is not less than $150. On the Coulterville trail there is a stretch of 39 miles to be made on horseback, with no house on the way; and on the Mariposa trail the nearest house to the valley is 25 miles off. Thus there is no mode of reaching the place except a hard ride over a very rugged road, and it is a severe trial to persons unaccustomed to riding horseback. A wagon road might be made, but some of the people on the route think it their policy to prevent the construction of a road. Near the Mariposa trail is a fine grove of the big trees. The number of visitors to Yosemite in 1864 was 240; in 1865, 360; and in 1866, 620.

THE MARIPOSA ESTATE.—The Mariposa Estate, or Frémont Grant, as it is sometimes called, contains 44,380 acres, or about 70 square miles. It reaches 12 miles from east to west, and 12½ miles from north to south. Its greatest length, from northwest to southeast, is about 17 miles, and its average width nearly 5 miles. Its northern line touches the Mercer river, the southern the town of Bridgeport. It includes the towns of Mariposa, Bridgeport, Guadalupe, Arkansas Flat, Lower Agua Fria, Upper Agua Fria, Princeton, Mount Ophir, and Bear Valley. The grant was made while California was under the dominion of Mexico, to Juan B. Alvarado, and it was purchased in 1847 by J. C. Frémont, who presented his claim for the land to the United States land commission, and it was finally confirmed to him, and the patent was issued February, 1856. The original grant was of land suitable for grazing purposes in the basin of the Mariposa river, but the boundaries were not fixed, and the grantee had the right of locating the claim on any land within a large area. When the grant was to be surveyed Frémont said he wanted a long strip of land in the low-land on both banks of the Mariposa river; but the United States surveyor told him the survey must be in a compact form. Then, instead of taking a compact area of grazing land and worthless mountain, he swung his grant round and covered the valuable Pine Tree and Josephine mines, near the Mercede river, besides a number of others which had been in the undisputed possession of miners, who had long been familiar with Frémont, and had never heard the least intimation from him that he would in any event lay claim to their works. Personal indignation thus came in to embitter a quarrel involving large pecuniary interests; but the patent did not necessarily give the gold of the grant to Frémont. Under the Mexican law the grantee had no right to the minerals, and the American law spoke of a confirmation, not an enlargement, of the Mexican title. Here then was another subject for litigation, and at last, in 1859, that matter was settled by a decision that an American patent for land carries the minerals with it. The adverse claimants defied the officers of the law; the mines were converted into fortifications; the mouths of the tunnels were barricaded; there were besiegers and besieged; several men were killed; but at last, in 1859, Frémont triumphed, and under his Mexican grant obtained land which the Mexican government did not intend to grant, and minerals which it systematically reserved.

In a short time after the title was satisfactorily settled the yield of gold from the quartz mines of the estate became very large. The monthly production in 1860 averaged $39,500; in 1861, $53,500; in 1862, the year of the great flood, which injured the mills, flooded mines, and broke up roads, $43,500; and in the first five months of 1863, $77,000. In March, 1863, the yield was $94,000; in April, $92,000; and in May, $101,000. The production seemed to have reached the figure of $100,000 per month, with a fair prospect of still further increase. It was at this time that the estate was sold to an incorporated company in New York city, and the stock put upon the market in the midst of the San Francisco mining stock fever, which extended its influence across the continent. The prospectus of the company presented a very attractive picture to speculators. The average monthly yield for three years and a half had been $50,000, and for half a year the net profits had equalled that sum. The reports of various mining engineers indicated that the results of future workings would be still better. Messrs. Wakelee and Garnett, who spoke with great caution, and expressed doubts about the value of the Mariposa, the Pine Tree, and Josephine mines, still thought that the monthly productions of the estate could soon be raised to $220,000, at an expense of not more than $50,000, leaving $170,000 net monthly income. Dr. J. Adelberg, speaking of the Pine Tree and Josephine mines, said:

> In regard to the value of the veins, I can say no more than that their yield in precious metal is limited only by the amount of work done in them; but I recollect Mr. Frémont once commissioning me to make an estimate as to their endurance in the limits of the longitudinal extent now opened. I found by calculation that they would yield for 388 years 100 tons daily, without the requisition of pumps. I mean down to the water level.

Mr. Timothy C. Allyn made a report on the property in December, 1862, and expressed the opinion that the yield could be increased $100,000 per month, gross, and $50,000 net. A report equally favorable by Mr. Claudet was also published. Professor Whitney, a most careful, conscientious, and competent authority, had said:

> The quantity of material which can be mined may, without exaggeration, be termed inexhaustible. I can hardly see a limit to the amount of gold which the property is capable of producing, except in the time, space, and capital required to erect the necessary mills, build roads to them, and open mines, so as to keep them supplied with ore.

With these opinions and facts, large quantities of the stock were purchased, and there were large quantities of it to be purchased, for the paper capital of the company was $10,000,000.

The company was organized by Frémont's creditors, who had become owners of the property; but instead of cancelling the debt and taking stock for it, they took a mortgage for $15,000,000, payable in gold, and issued the stock subject to that debt, which was supposed to be the only incumbrance on the property; at least that was the supposition of many who bought the stock. It soon appeared, however, that there were $480,000 in gold due, besides $300,000 on the garrison lien, $50,000 on the Clark mortgage, and $130,000 to workmen and others in California. The new company selected Mr. F. L. Olmsted for their manager, and he took charge of the estate on the 14th November, 1864. He found everything in confusion. The production had fallen off very suddenly after the sale. It seemed as if every nerve had been strained to make the yield of May as large as possible, and that as soon as the sale was made the production decreased more than 50 per cent. The yield for the first five months of 1863 before the sale was $385,000, and during the last six after the sale was $186,993. In the former period there was a net profit of $50,000 per month; in the latter a net loss of $80,000.

In May, 1864, Professor Silliman made a report on the estate, in which he said:

> A person accustomed to view mines must be deeply impressed on the first view of this estate, not more with the great extent and vigor of the former workings—evidence of which

is seen equally in the underground extraction and in the surface works, railroads, mills, trails, wagon roads, warehouses, and workshops—than with the equally conspicuous fact that the former owners had no regard for their successors, inasmuch as they have in every instance violated in the most remarkable manner that fundamental maxim of all successful mining, namely, to keep works of exploration well in advance of works of extraction. The neglect of this maxim, in ordinary cases; is never of doubtful issue. In your case the result has been peculiarly unfortunate, since your estate is not a mine, but a vast collection of mineral veins, on many of which valuable mines may be developed, and on some of which such developments were made of an encouraging character, but the neglect to apply the principle in question has resulted in the complete suspension of three of the mills, the partial suspension of a fourth, and the supply of the fifth for a time with an inferior quality of ore, all because the veins on which these mills depended for ore were worked on the improvident plan of taking all the ore in sight as far and as fast as it could be found, but never anticipating the evil day, sinking shafts and driving levels long enough in advance of the calls of the present hour to foresee disaster, much less to prevent it.

A mine is a storehouse in which are garnered certain treasures of large, it may be, but not inexhaustible supply. Certain it is, the ore which has been mined will never recur. Hence, it is the fate of all mines at some period to become exhausted. The only compensation to this circumstance is in the possession by one company of a considerable number of mines which may be brought, in succession, into activity, so as to supplement each other. Your position in this respect is one of immense strength; not only do you hold on the Mariposa estate a vast plexus of veins, of most of which very little is known at present, but you also own a great length of country on several veins, the character of which is already proved. It follows from this state of facts that, with the frugal and timely application of capital, you ought never to be in a position where the partial or complete exhaustion of a particular mine, or of several mines, should be severely felt on your general production, nor would it be so to-day had it been the interest of those who preceded you to apply the simple maxim already quoted. But the reckless disregard of this sound principle has resulted, not only in a partial suspension of your production of gold—amounting to a serious disappointment of well-founded hopes—but, still worse, in the almost destruction of certain parts of the mines, where the usual piers of vein have been removed for milling, leaving the mines to crush in, endangering not human life only, but the very existence of the mines themselves. The simple result of all this has been, that your manager found himself, at the outset of your occupancy, face to face with a most embarrassing and painful state of facts, with the alternative before him of throwing off the duty he had undertaken or of grappling with the difficulties and, by a series of judicious measures, extricating this noble estate from its disastrous position. Fortunately for all concerned, he elected the latter alternative; and it will give me pleasure to point out in what manner he has, with great good judgment, proposed to meet the difficulties he has found.

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It is quite obvious, from the facts and statements already detailed in this report, that you hold an estate of very great value, but also in a great degree undeveloped, and demanding a large amount of active capital for its proper management. That the judicious use of money will be rewarded, and that speedily, by exploring the undeveloped quartz veins of the estate, is too obvious, I trust, after the arguments and facts already set forth, to require further illustration. All explorations will not be fruitful certainly, but those which are so will become so largely remunerative that they will cancel the others. By no other plan can you hope to manage the estate with honor or profit. By this method you will be sure to develop a vast value, which will render your stock desirable as a permanent and safe investment. By any other system you may attain a spasmodic vitality—to be followed soon by a total collapse.

Your manager fully appreciates these views, and his plans now in progress of development will not fail to secure the early and permanent prosperity of the Mariposa estate.

In 1864 the yield was $465,000, and the expenditure of the mines and mills $760,000. With a debt of $3,000,000, (that was about the figure on the 1st January, 1865,) and a monthly loss of $20,000, the company was evidently not in a prosperous condition. On the 23d January, 1865, a committee of stockholders, appointed to investigate the condition of the company, made a report, and recommended that money be raised by assessment or loan to pay the most pressing debts, so that the work might be continued. They gave it as their opinion that the property was "worth preserving to the stockholders," and that the embarrassments were "owing to defective organization and want of working capital." The company did not succeed in raising the money to pay their most pressing debts, and the estate was placed in the hands of Dodge Brothers, creditors, for the purpose of enabling them to work it and pay their own and others' debts.

The trustees found, according to their own statement, that they had spent more at the end of a year than they had received; and the company being dissatisfied, brought suit and obtained the appointment of a receiver, who is now (May, 1867,) in possession.*

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* Mr. Mark Brumagin, president of the company, under date of September 6, 1867, gives the following statement of the present condition of the Mariposa estate:

After a period of legal and financial difficulties which have weighed heavily upon the Mariposa estate, the company have succeeded in successfully terminating the long pending law suit with the lessees. A final settlement has been made with the Messrs. Dodge Brothers, (the lessees,) by which they relinquish to the company all their rights under the Olmstead lease for the possession of the whole property.

The floating debt has been reduced from about $200,000 to less than $60,000, which has been concentrated into holders who are interested in the success of the company, and the greater portion of which is made payable in instalments running through the next twelve months.

The Mariposa estate consists of upwards of 44,000 acres of gold-bearing land, in the heart of the mineral region of California. It contains more than 1,000 auriferous quartz veins, of which some 30 have been partially opened, and proved to be paying veins when provided with proper reduction works. Of these mines only five have been supplied with machinery, and that of a primitive kind, and very inefficient for saving gold. Where thousands have been taken from the estate, millions of dollars have been lost by bad management and worthless machinery.

The working of the Josephine and Pine Tree mines for the year 1860, and to the date of the incorporation of the company, shows an average gross yield of $8 53½ to the ton. From that time the yield for the above two mines has been respectively, as follows:

The Pine Tree mine, under the succeeding management, yielded, in gross, an average of $6 per ton; the lower run having been $4 21, and the highest, $9 97 per ton.

The books kept by the Olmsted management also exhibit the following in regard to the Josephine mine: The lowest run for any one clean up was $2 42 per ton; the highest, $7 05 per ton, making an average gross yield for this period of $4 52 per ton. In brief, the average yield of this mine was at that time so low that it was partially abandoned as worthless by their method of saving gold.

Under the next management, (that of the lessees of the company who succeeded Olmsted,) the books show that the quartz from these two mines was worked together with an average gross yield of $9 01 per ton, the ore having been more or less selected.

The Pine Tree vein is in some places over 30 feet wide, and runs parallel with the Josephine, which has a width of some 12 feet, both mines cropping out on the summit of Mount Bullion, 1,500 feet above the Mercer river, at which the Benton mills are located.

The Josephine contains considerable sulphurets, while the Pine Tree has rather the character of a "free gold" vein. Both have more or less of oily substances in the seams of the veins. The ore contains largely of "float gold," so fine that it floats for hours on the surface of the water.

Quartz from these mines is now supplied to the mills from the tunnels penetrating the veins near the top of the hill, but it is designed to open them by a tunnel at the base, some thousand feet below the present workings, which will insure an unfailing supply of ore.

Under the company's, or present management, since we obtained full possession, we have changed the Bear Valley mill into the "eureka process" for saving gold. This mode of disintegration produces a fine, almost impalpable powder, like superfine flour. Half a ton of this is enclosed dry in an iron receiver. Superheated steam or gas is admitted, which, in the course of a few minutes desulphurizes and drives off all base metals and oily substances. Quicksilver is then introduced, and a portion evaporized, and is afterwards condensed by common steam and cold water. An ingeniously constructed shaking table, of copper, about 20 feet long, on a wooden frame, with riffles of a peculiar formation, gives to the water and pulverized substance, with the amalgam, the same action as that of the ocean surf, an undertow. As the mass descends on the table, the amalgam, from its metallic weight, gradually clears itself from the quartz substances, and the gold is easily and quickly collected in the troughs of the riffles; and so effectually that the residue contains scarcely a trace of gold.

With this mill the company have recently worked some 800 tons of quartz from the Josephine mine. The lowest yield at any clean up was $31 per ton; the highest was $173 per ton; giving an average of $40 53 per ton. In the greater portion of this quartz not a particle of gold could be discerned before crushing. From these facts it will readily appear why the property has hitherto paid no dividends.

Captain Henry J. Hall, a practical and experienced quartz miner, has now charge of the mines and mills of the company, and is adapting the eureka gold-saving process to all the mills of the estate. The aggregate capacity of these mills under former management was 292 tons daily, or about 7,500 tons per month, a capacity which still exists. The mills are located near the Josephine, Pine Tree, Mariposa, Mount Ophir, and Princeton mines, all proved to be large, well defined, and inexhaustible veins. There may be easily taken out from these five mines, at the present time, 200 tons of gold ore per day, and increased on the present

Experienced quartz miners, familiar with the estate, are almost unanimous in the opinion that the Princeton, the Pine Tree, and the Josephine mines are far from exhausted, but, on the contrary, that they are all very valuable, and ought to be made to pay well, and that the failures of the last four years are to be ascribed mainly to bad management. It is true that when the Mariposa company took possession the mines were not opened in advance as they should have been; but they were opened, the position of the pay chimneys was determined, the hoisting works and pumps and mills were in working order, with capacity to crush and amalgamate 150 tons of rock per day; there were experienced miners present, familiar with the character of each vein; there was a railroad for transporting the rock of two of the principal mines to the mill; and there were improvements that were indispensable, and that could not have been placed there for less than a quarter of a million dollars. The property, however, was not managed properly, and the result was a failure, which is the more remarkable because it followed immediately upon the heels of the most brilliant success.

PRINCETON.—The Princeton mine has been one of the most productive in California, and has been noted for both the abundance and the richness of its quartz. For a time it yielded $90,000 per month from milling rock, and this is more than any other mine of the State ever did.

The mine is situated about half way between the Mariposa and the Pine Tree mines, and is on a hill easily accessible. The course of the vein is northwest and southeast; the dip, 55° northeast; the thickness varies from a few inches to 10 feet. The vein has been opened to a depth of 560 feet on an incline, and 200 feet below the surface; drifts have been run 1,200 feet along the vein, and at the deepest workings the drifts extend 500 feet. The richest rock was found within 100 feet of the surface, where the pay was $70 per ton from milling well, besides large numbers of specimens, of which it is said that not less than $100,000 in value were stolen by the miners. Below this rich mass of rock the quartz gradually became poorer, and there were spots which did not pay for working; but it is said that there is still an abundant supply of good milling rock in sight.

Professor W. P. Blake made a report on the mine in November, 1861, and said:

> The vein is composed of white friable quartz, and is divided into parallel layers or plates by thin slatey films, which are generally charged with fine-grained pyrites and free gold. The body of the quartz bears white vein pyrites crystallized and spread in irregular patches and a small portion of galena, together with free gold in irregular ragged masses, in plates and scales, and sometimes crystals. The gold appears to be most abundant in the neighborhood of the galena, and is found not only with the iron pyrites striking its sheets through its substance, but entirely isolated from it and enveloped in the pure white quartz. Some of the specimens preserved are exceedingly rich and beautiful, and just before my examination of the vein some superb crystallizations had been broken out. These crystals are bunches of octahedrons, with perfectly flat and highly polished faces from one-eighth to three-sixteenths of an inch across, and are attached to masses of white quartz.

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openings by enlarging the working facilities, to 4,000 tons per day. The cost of mining and reducing the ore will be less than $10 per ton, and may yield an average of $40 per ton. The old mills have produced upwards of $3,500,000. Under an intelligent system of working they ought to have yielded over $10,000,000.

The amount of profits from the estate can only be estimated in proportion to the number of mills provided for the reduction of the ores. The reader may draw his own conclusions from the facts and figures herewith presented.

It will be remembered that the representations heretofore made by the undersigned were based on the low estimate of a sure gross average yield of $20 per ton, by the new reducing machinery. The present working shows that such estimates may no longer be regarded as theoretical, as the actual results fully illustrate. Theywill be amply confirmed by the future of this great property.

Professor Blake made a second report on this mine in December, 1864, and said:

> It is evident on a careful examination of the surface that there is a want of conformity in direction between the vein and the slates. The slates on the west side are curved towards the vein in the form of a bow, the ends of the curve appearing to abut against the vein at both ends, the vein forming in its line of outcrop, with respect to the slates, the chord of an arc. There is also a want of conformity in direction between this body of curved slates on the west side of the vein and those on the east side of it, showing with most distinctness at the north end, near the mouth of the upper drift. On the east side the trend of the slates is seen to vary at different places from north 45° west to north 95° west. They are nearly east and west at the north end of the vein. * * * There is also a want of conformity between the body of curved slates on the west side of the vein and the slates still further to the west, as if the curved body of slate had been broken from some other place and forced into its present position. The line of contact is not very distinct, but just in the position we would expect to find it we see a quartz vein which seems to mark the place. It is approximately parallel with the Princeton vein, and is also gold-bearing.
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> This want of conformity in the direction of the slates on the opposite sides of the vein and with the course of the vein itself, and the fact that the ends of the layers of slate abut against the vein, or in other words, that the vein does not coincide with the plane of the bedding or stratification of the slates, justifies the conclusion that it is a fissure vein rather than a bedded mass, as has heretofore been generally supposed. It evidently occupies the line of break between the two distinct bodies of slate.
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> The mineralogical character of the slates on the opposite sides of the vein is also different. The slates on the west side are much more sandy than those on the east, which are argillaceous and in very thin layers of uniform composition, presenting the well-known appearance and character of roofing slates. There are several layers in the series on the west side which might be called sandstones rather than slates. There are also in connection with these sandy bars of a hard argillaceous rock, with an obscure slaty structure which resists weathering more than the surrounding portions and stands out in well-defined outcrops. These two bars of rock are each from six to eighteen inches in thickness, and are about 170 feet apart.
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> It is a curious fact that the gold-bearing part of the vein appears to have a certain relation to these peculiar argillaceous rocks or strata, for it does not extend beyond the line of contact of these strata with the plane of the vein. So also in the northern extension of the Princeton vein, half a mile to the northwest, at the Green Gulch mine, where the vein was productive, the same peculiar rock is found in connection with the vein on the west side.

Near the mill the vein splits and the two branches run off southeastward nearly parallel with one another. At a distance of a mile they are about 300 yards apart. These branches have not been well explored or prospected, so not much is known of their character. On the main vein there are seven shafts and a great number of workings of different classes, such as might be expected of a mine that has yielded $4,000,000 and sustained a considerable town. From January, 1859, till June, 1860, Steptoe and Ridgway had charge of the mine, and extracted 2,000 tons, which averaged $18 per ton. From June 1, 1860, till November of the same year, under the management of Park, 23,916 tons of quartz were crushed, yielding $527,633, an average of $22 25 per ton. In 1862 and 1863 the production was 121,000 tons of quartz and $2,000,000 of bullion, averaging $16 50. In 1864 the yield of bullion was $243,707. In 1863, when the mill was working rock which yielded $53, the tailings, according to assay, contained $13 56 per ton. The pay was distributed rather in an irregular mass than in a chimney; but Professor Blake expressed the opinion in his report of 1864 that there was a chimney, and that its dip was 18° to the horizon.

The Princeton mill has 24 stamps, and is the smallest on the Mariposa estate, at least of those owned, erected, and worked by the Mariposa company. The capacity of the mine far exceeds that of the mills, and while the former was in a productive condition much of the ore was sent to other mills. The gold in the quartz is coarse and is easily caught in the battery, or at least most of it; but the assays of the tailings show that great quantities of it were lost. The heap of tailings at the mill is immense, and it will no doubt be worked over at some day with a profit, if not all blown away. The sand being fine many pounds of it are carried off every hour when the wind blows in summer. The mill was driven by steam. The stamps weigh 550 pounds and made 70 drops per minute. Both mine and mill are now idle.

THE PINE TREE.—The Pine Tree mine, contiguous to the Josephine, and thirteen miles from the town of Mariposa, is considered to be on the main mother lode, which runs northwest and southeast, dips to the northeast, and is here in places 40 feet thick. The ore is extracted through tunnels and carried down to the mills on a railroad. The workings are 500 feet deep and 1,000 feet long in the vein. There are seven pay chimneys, which vary in length, horizontally, from 40 to 200 feet. The rock in each chimney has a peculiar color or appearance, so that persons familiar with the mine could tell at a glance from which a piece of quartz came. The coarsest gold was found in the narrowest chimney. In three years previous to May, 1863, the Pine Tree and Josephine mines produced 45,000 tons of ore and $350,000 in bullion, an average of $7 77 per ton. In 1860 these mines produced 12,154 tons and $113,530, or $9 34 per ton; in 1861, 21,576 tons and $173,810, or $8 05 per ton; in 1862, when the dam was carried away by the flood, nothing; and in 1863, previous to June, 6,000 tons and $35,000, or $5 83 per ton. The total expense was $5 per ton for a portion of the time at least, the cost of transportation by car being 72 cents. In 1864 the Pine Tree yielded $67,940. In December, 1863, when the ore paid $29 to the ton, the refuse tailings assayed $16 to the ton, showing a great waste. There is a large quantity of good ore now in sight in the mine.

The particles of gold in the Pine Tree quartz are extremely fine, usually so small as to be invisible to the naked eye. As a consequence it is very difficult to catch the metal in the process of amalgamation, and Professor Ashburner, in a report made in May, 1864, said that 70 per cent. of the gold in the quartz worked in the Benton mills was lost, or, in other words, only 30 per cent. of it was saved. This fact was ascertained by "a series of assays upon the tailings which have been allowed to run to waste."

In the same report he said, "I think the Josephine vein, as it is called, is nothing more than a branch from the Pine Tree, and the two systems of workings, as they have never been carried on in connection, have given rise to two mines."

Dr. J. Adelberg made a report on the mining property of the Mariposa grant in August, 1860, and in it he said:

> These two veins run parallel on the whole, but sometimes a little diverging, sometimes a little converging; sometimes running together and forming two distinct divisions of one vein. They belong to distinct geological periods, the Pine Tree being earlier and the Josephine of more recent formation. The ores of both veins are very distinct, the older vein bearing, in those depths now laid open, mostly oxyds and carbonates, (among which the blue and green carbonate of copper is very characteristic,) and the Josephine, or more recently formed vein, bearing the iron and copper as sulphurets only. The eruption of gold-bearing quartz has formed here veins which are equalled in extent by no other known gold-bearing quartz vein.

Messrs. Garnett and Wakelee, who examined the Pine Tree and Josephine mines in May, 1863, expressed the opinion that they did not contain any considerable body of ore then in sight to pay by the modes of amalgamation in use at that time, and the only hope for making these mines "an active element of production instead of a consuming expense" lay in improvements in the system of working the ores.

JOSEPHINE.—The Josephine mine is on a mountain side, 1,600 feet above the level of the Merced river. The vein runs northwest and southeast, and dips to the northeast. Professor Silliman says it is a contact deposit between serpentine and shale; but Mr. Kelten, who has been a superintending miner in the Josephine for more than ten years, says that in some places there is green stone, and in others slate on both sides, and it is richer in the slate than the green stone. There is no gouge in the green stone. The lode varies in width from 5 to 30 feet, averaging more than 10. In those places where the vein is small the quartz is mixed with slate. The mine has been worked through three tunnels, the upper one being 100 feet above, and the lower 180 feet below the middle tunnel or Black drift, as it is called. The drifts have been run 500 feet in the lode, and the depth of the workings perpendicularly is 520 feet.

The pay-rock has been found in seven chimneys, which are from 40 to 100 feet in length horizontally, and are separated by barren streaks from 4 to 6 feet long in the drifts. The pay chutes dip 45° to the southeast; but the dip is less regular on the under than on the upper side of the chute. The richest deposit is found along the foot wall, and a small streak of pay is found along the foot wall in the barren chutes. The Josephine ore has usually been worked with that from the Pine Tree in the Benton mill, so that separate accounts have not been kept of most of the workings. The Josephine vein is considered a branch of the mother quartz lode, from which it separates at the Josephine mine, running northwestward nearly parallel with the main vein. At a distance of half a mile from the fork they are about 300 feet apart. Although the mine is now lying idle, miners say that there is a large quantity of $20 rock in sight.

The indigo vein, so called because of the peculiar blue color of the rock, is 4 feet wide, and 450 feet west of the Josephine mine. The vein stone is talcose, and in places is rich in gold. It is called India-rubber rock by the miners, and is difficult to break with the hammer, but tears out well when blasted. The vein has not been opened, but a tunnel has been run through it, and it has been prospected a little in spots on the surface.

MARIPOSA.—The Mariposa mine is situated on the eastern border of the town of Mariposa, on the Mariposa lode, the direction of which is nearly east and west, the dip 51° south, and the width of the main vein from four to eight feet. Near the mill the vein forks, one prong running westward in the line of the maine lode, and the other running north of west. At a distance of 300 yards from the forks, the two prongs are not more than 60 yards apart. Each fork is about 3 feet thick. The rock is a white ribbon quartz; the walls are a black talcose slate. There is but little gouge, and the quartz is so hard that no progress can be made without blasting. East of the fork the gold is in fine particles, and is evenly distributed through the pay chute, while west of the fork the gold is collected in rich pockets, which are separated from one another by large masses of very poor quartz. These pockets contain almost invariably arseniurets of iron, accompanied by pyrites. The presence of these minerals is considered a certain sign that a good deposit of gold is not far distant. One pocket paid $30,000, another $15,000, and numerous other sums, varying from $100 to $1,000. The great richness of the vein is proved by the facts that the decomposed quartz at the surface was worked or washed for a distance of half a mile, the ravines immediately below the lode were famous for their richness, and drifts have been run a quarter of a mile under ground. It is said before Fremont obtained possession, squatters took $200,000 from the mine. The quartz taken out in 1864 averaged $25 per ton; but afterwards the average yield was only $11. Persons familiar with the mine say an abundance of rock might be obtained to yield $12 or $15. Before the sale of the grant to the Mariposa company the mine was leased to Mr. Barnett, who paid 10 per cent. of the gross yield, a very good share, and afterwards when he was told that he could not have the property on those terms he offered to pay 30 per cent. of the gross yield, and to give good bonds. His offer was rejected, and the mine is now idle. Mr. Barnett worked the mine on a very economical plan. His stamps had wooden stems; he amalgamated in arrastras, and his mortar was fed from a hopper or self-feeder. Little hand labor was done in the mill in the daytime, and none at all at night. Indeed, everybody left the mill at supper time, and it was allowed to run without supervision till morning. The quartz was taken out under Barnett's directions, who having spent many years at the place was thoroughly familiar with it; and before going to the mill, all the barren pieces were rejected. It was supposed that the mine would pay better if it were worked on a larger scale, so the mill that had stood at the Green Gulch mill of 40 stamps was moved to the Mariposa mine in 1864, in accordance with the recommendations of Professor Ashburner.

Professor Silliman, in a report made in May, 1864, said:

> I feel convinced that the Mariposa vein is, on the whole, the most remarkable auriferous vein yet developed on the Mariposa estate, and if the half which is believed of it by those who know it best should prove true, it will alone almost sustain the estate. The mill now erecting in Mariposa creek is the same which has been removed from Green Gulch, where, as it proved, there was no further use for it. Mr. Ashburner having examined and reported approvingly on this removal, I have not felt it needful to re-examine the evidence, the decision undoubtedly being a wise one. The fault of the other mills (except the Princeton) of being set too low has been remedied here, and with a well-considered system of amalgamation, there can be no doubt that excellent results will be arrived at in working the mill in its new and well-chosen position, nor can there be any doubt that the mill will receive an ample supply of quartz to engage it fully in crushing.

The gross yield of the mine in 1864 was $84,948; but there was no profit, and among the intelligent miners in the neighborhood there is much doubt whether enough pay quartz could be obtained to keep a 40-stamp mill going.

Messrs. Wakelee and Garnett in their report on the grant say:

> The Mariposa vein we examined more particularly, as it has been quite celebrated for the extraordinary richness of its pockets of massive gold. The vein consists of a main trunk and two branches. It is in the latter that these deposits have been found. They have not been worked upon any regular system, but have been much burrowed into by different parties in quest of these rich pockets. The quartz itself is almost entirely destitute of any trace of metal, and its value seems to consist entirely of these massive deposits. It is needless to add, perhaps, that from this peculiarity it furnishes a very uncertain basis for any extensive system of mining. The main trunk of this vein differs from its branches, and the quartz found in it is uniformly charged with the metal. The ores yield, according to the best information we could obtain, about $16 per ton.

GREEN GULCH.—The Green Gulch mine, in the vicinity of the Princeton, has been explored by a shaft 200 feet deep, and by drifts running 400 feet horizontal, and the conclusion is that the deposits of auriferous quartz are not sufficiently near together to pay for working. The vein is about three feet thick, but the quartz is mixed in places with slate, which reduces the yield to a point so low that there is no margin for profit. Some rich bunches of rock have been found, and under the encouragement given by them a 40-stamp mill was erected, and new explorations were undertaken; but the rich bunches were too far apart, and the mill was afterwards removed to the Mariposa mine. The yield of the Green Gulch mine in 1864 was $19,509. In December, 1863, while the rock was yielding $38 per ton, an assay of the tailings showed that they contained $6 50 per ton.

OTHER MINES ON THE MARIPOSA ESTATE.—The Oso mine, half a mile from Bear valley, is in a very narrow vein of decomposed talcose matter, running across the slates. It was very rich near the surface, and according to rumor the sum of $400,000 was taken from a shaft 50 feet deep and 7 feet long on the vein. No work has been done at the place for years.

The New Britain or Missouri mine is two miles northwest of the town of Mariposa. The vein averages about two feet and a half thick, runs east and west, dips to the south, and can be traced on the surface by croppings for four or five miles. The vein stone is a soft white and yellow quartz, which breaks up like slaked lime when exposed to the air. The walls are of hard black slate. The only pay chimney which has been worked dips to the east with an angle of 50°. The quartz in this chute has been taken out to a depth of 80 feet, and it contained a number of very rich pockets, one of which was taken out by Mr. Barnett, and yielded $52,000, at an expense of $5,000. In one day and a half he took out $9,000. Professor Silliman says it is a "very promising vein."

The Mt. Ophir mine is on the mother or Pine Tree lode; has been worked extensively, and never rivalled the Princeton, Pine Tree, Josephine or Mariposa mine in the amount of production. The yield in 1864 was $12,540. The Mt. Ophir mill has 28 stamps, now idle.

Mariposa Mills.—The Benton mills, built to work the quartz from the Pine Tree and Josephine mines, stands in a deep cañon on the Mercer river, by the water of which they were driven; but the dam which supplied the water was carried off by a flood, and the mills have been standing idle. The number of stamps is 64.

The Bear Valley mill has 12 stamps. At this mill the Lundgren pulverizer and the Ryerson amalgamator are now being used.

The Lundgren pulverizer is a barrel five feet in diameter and three feet in length, made of boiler iron three-eighths of an inch thick, heavily riveted. Inside, the barrel is shod with iron shoes an inch thick. A door a foot wide and two feet long is placed lengthwise on the side of the barrel. There are two of these barrels at the Bear Valley mill, and the cost of the two with their gearing was $2,300; but if many were demanded they could no doubt be made for $1,000 each. The barrels revolve horizontally, making 24 revolutions per minute, and requiring a six-horse power engine for two of them. A charge is 800 pounds of quartz and 2,400 pounds of ounce musket balls made of chilled iron. The quartz, previous to going into the barrel, is crushed to about the size of grains of wheat, and after being in the barrel one hour comes out an impalpable powder, as fine as the finest flour. The powder is so fine that if it were pounded dry in the open air much of it would float away. The thoroughness of the pulverization is claimed to be the great advantage of this machine.

The quartz powder is transferred from the barrel into the Ryerson amalgamator, an upright barrel, made of strong boiler iron, with a bottom shaped like an inverted cone, round which winds a pipe pierced with a number of little holes. The barrel being charged and closed, superheated steam is thrown in and then quicksilver, which is converted into vapor and made to pervade the whole mass. A cold bath condenses the quicksilver, and the charge is discharged into a shaking table or settler.

The amount worked daily by these processes is nine tons of Josephine ore, and the yield varies from $39 to $173 per ton, with an average of $45, at an expense of $6 50 per ton. The rock thus worked is taken without selection from the pay chimney, and the body of ore now in sight, and presumed to be of the same quality, is 280 feet high, 45 feet wide longitudinally on the same vein, and 3 feet thick—an amount equivalent to 940 tons. It is presumed that the body of the quartz of that quality is much more extensive, both horizontally and vertically, than the present shafts have gone.

The mills of the Mariposa estate are the Benton, 64 stamps; the Mariposa, 28 stamps; the Mount Ophir, 28 stamps; the Princeton, 24 stamps, and the Bear valley, 12 stamps—making 156 stamps in all.

The yield of the estate was $474,000 in 1860; $642,000 in 1861; $522,000 in 1862; $385,000 (with $50,000 net per month) in the first five months of 1863; $481,832 in 1864; and $230,000 in 1865. During the first half of 1867 the mines and mills all stood idle; but of late a little work has been done with the Ryerson and Lundgren processes.

The Stockton creek mill, used by Mr. Barnett for working the quartz of the Mariposa mine while he was lessee, contains ten stamps, with square wooden stems and wooden collars, driven by water and a wooden wheel. There was a self-feeder or hopper to supply the batteries with quartz, and the pulp, after leaving the mortar, was ground in an arrastra. The mill is a mile east of Mariposa, and has been idle for two years.

Hunter's Valley, ***Oaks and Reese.***—The Oaks and Reese mine, called also the Potts, is 3,000 feet long, in Hunter's valley, 16 miles northwest of the county seat. The claim includes two veins, 1,200 feet on one which runs northeast and southwest and dips to the southeast at an angle of 65°, and 1,600 feet on another which runs northeast and southwest. The former is one of a series of parallel veins; the latter is known as the Blue Lead, and it is remarkable, because the numerous cross leads running at right angles are found only south of it, and appear to be cut off by it. The Blue Lead is nearly vertical, from 12 to 30 inches wide, yields $45 to the ton, and has been opened to a depth of 165 feet and a length of 150 feet. The other vein is six feet wide, yields $20 to the ton, has been opened to a depth of 165 feet, and to a length of 50 feet. The mine has been worked with a four-stamp mill, but a new twelve-stamp mill has been erected, and it began to run on the 7th of October. The copper aprons below the battery are plated with silver, with which mercury forms an amalgam more readily than with copper, and the apron will be in the highest state of efficiency immediately, whereas several weeks' time would be required if the surface were of copper. The plating is done by galvanism and cost $5 per square foot. Baux and Guiod's pans are used for grinding. The mill is driven by steam, and also the hoisting apparatus. The quartz is let down from the mouth of the mine to the mill in a tramway, and the loaded cars as they go down pull up the empty ones. The transportation does not cost more than $1 50 per day. The yield of the mine has been $30,000. A patent has been applied for.

The Floyd mine on one of the southern spurs of the Blue Lead has paid well, but now produces nothing.

The same remark applies to the Carson mine, which has a five-stamp mill standing idle.

Epperson.—The Epperson mine on Bear creek, six miles east of Coulterville, is on a vein which runs east and west and dips to the north. There is a shaft 60 feet deep, and a drift 20 feet long has been run on the lode. About 200 tons have been worked, and the yield was from $9 to $13 per ton. There is a nine-stamp mill which, with the mine, is standing idle.

Black.—The Black mine is sixteen miles eastward from Coulterville, on the Blue Lead, which runs east and west and dips to the south. The hanging wall is mountain limestone and the foot wall yellow slate, and the vein stone contains marble. The average yield is about $40 per ton, or was for all the work done. The mine has been standing idle now for several years on account of the water, which at times has risen nearly to the surface. A shaft was sunk to a depth of 170 feet. There is no mill; all the crushing was done with an arrastra.

Ferguson.—The Ferguson mine, 25 miles eastward from Coulterville, has been worked five or six years. The ore yields from $25 to $100 per ton, and is worked in a ten-stamp mill driven by water.

Louisiana.—The Louisiana mine, ten miles eastward from Coulterville, is 3,600 feet long, on a vein that runs northwest and southeast, dips to the northeast, and has a width varying from 2 to 16 feet. The quartz contains sulphurets of iron, zinc and lead. The free gold amounts to $6 or $8 per ton. The vein has been opened to a depth of 140 feet and a length of 130 feet by drifts from the bottom of the main shaft; but there are a number of shafts 15 or 20 feet deep, and gold has been found in all of them. The ore is easily extracted, but the slate walls require much timber to support them. Along the foot wall there is a streak of soft yellow sandstone six or eight inches thick. The mine makes much water, and at the first of June the pump hoisted 37,000 gallons daily. There is a 10-stamp mill which has lain idle for several years, but has lately commenced to run again.

Flannigan.—The Flannigan mine, 10 miles eastward from Coulterville, was discovered in July, 1861, near the summit of a ridge, at an elevation of about 3,000 feet above the sea. A miner working a placer claim in a gulley found a rich spot, where he picked up, among other pieces, a nugget that weighed an ounce and a boulder as large as a man's head containing $87. He searched for a quartz vein and found this one. It runs north and south, cuts across the slates, dips to the west, and is five feet wide. There are smooth slate walls on both sides, and there is a putty gouge three inches thick. All the rock so far found is rich enough to pay, and the average yield is $35. The mine has been worked with an arrastra for six years, but there are now 500 tons of ore stacked up at the mouth of the tunnel, and preparations are being made for the erection of a ten-stamp mill. The quartz is taken out through a cross tunnel 175 feet long, and from that drifts have been run 225 feet on the vein, and a shaft has been sunk 50 feet. A horse is found in one part of the lode. The quartz is white, and much of it slakes when exposed to the air. The crushing has been done heretofore by two arrastras, and the total expense per ton has been less than $5. The cost of crushing and amalgamating in the arrastra is estimated at $3 50 per ton, and of extraction at $1.

COWARD.—The Coward mine, 12 miles eastward from Coulterville, was located in 1858, and has been worked constantly since. The first owner, a Mr. Funk, fell from the wheel the day the mill started, and was killed by the fall. H. G. Coward is the present owner. The vein runs east and west, dips to the north at an angle of 45°, and is four feet wide in the middle of the pay chimneys, which become narrower gradually in each direction horizontally as they pinch out. These chimneys are two in number, each about 100 feet long, and they dip to the east at an angle of 40°. The width is very regular in going down with the dip. They had been worked to a depth of 170 feet. The walls are of smooth black slate, and there is a black putty gouge. Most of the gold is found near one wall or the other, and sometimes on both, but in places where a horse is found in the vein the gold is all confined to one side. The average yield is, and has been constantly, about $40 per ton. The quartz contains little pyrites, and the tailings have never been assayed. There is, or was in May, a five-stamp mill, which was to be abandoned, and a new ten-stamp mill was to be erected on the north fork of the Mercede, one mile from the mine. The dam and flume were to cost $600, and the wagon road $1,000. Ten or 12 men were employed.

CALICO.—The Calico mine, on the same lode as the Cherokee, has been opened by a tunnel 160 feet long, and a drift of 35 feet in pay rock estimated to yield $20 per ton. No mill has been erected, nor has any of the rock been crushed.

COMPROMISE.—The Compromise mine, on a small vein near the Goodwin, was worked for two years with a loss.

MARBLE SPRING.—The Marble Spring mine, 16 miles eastward from Coulterville, was discovered in 1851, and a five-stamp mill was erected there. The first owner found it unprofitable, and he sold to a gentleman who kept it going for seven or eight years, part of the time at a profit, and he sold to others who spent $15,000 in experiments and lost money, though the rock yielded $25 per ton. The mine is now the property of H. G. Coward and others who have lately reopened it. The vein is three feet thick, runs northwest and southeast, and dips to the east. The pay chimney dips to the southeast. The lode contains pockets in which the gold is very coarse, and is distributed in beautiful threads through a compact bluish quartz, making together the finest material for "quartz jewelry" in the State. The main tunnel is 600 feet long. The old mill has been moved away. The mine is at a high elevation, near the summit of a mountain.

CHEROKEE.—The Cherokee mine, near the Goodwin, was discovered by a Cherokee named Rogers, in 1857, and was very rich at the surface. Some of the gold was coarse enough to be pounded out in a hand mortar. The rock worked in arrastras averaged $100 per ton. In 1859 a steam mill with eight stamps and two arrastras was erected, and the rock yielded $35 per ton for about a year, and then work stopped. The mill was sold at sheriff's sale and moved away, and nothing has been done at the place since. The deepest workings were through a tunnel 400 feet long, and another lower tunnel was commenced, but the mine was abandoned before it reached the lode. As the workmen who were employed have all left it is difficult to get any accurate information; but some miners in the neighborhood say that the mine was worked in a careless manner;

that the proprietors squandered their money, and that although there was a horse in the lowest workings, the completion of the lower tunnel would in all probability have struck the lode below the horse. The vein averages two feet wide, runs east and west and dips to the north. The pay chimneys dip to the east.

Shimer.—The Shimer mine, 10 miles east of Coulterville, was discovered in 1858 by a miner who, while digging a ditch for placer mining, found some rich boulders of quartz, and on searching he found the lode. In a few days he took out enough gold to pay for several arrastras, with which the mine was worked for a year and a half, the rock yielding from $150 to $500 per ton. Rumor says that the total yield in this time was $200,000, three-fourths of it net profit. He then erected a steam mill, with two stamps and two arrastras; but the water became troublesome, and for five years the mine has been idle, and for two years before the work was irregular. The mine was opened by a cross tunnel, which, after running 400 feet, struck the lode 140 feet from the surface, and a shaft was sunk 40 feet below the tunnel. The failure of the mine is attributed by some persons in the neighborhood exclusively to bad management. It is said that the last rock crushed yielded $60 per ton, and there was more of it in sight. There were five partners, most of whom were spendthrifts, and shortly before their failure they took a trip to Sonora and spent $4,000 in one debauch. Those who had not squandered their money had sent it away, and when the water came in they could not afford to buy a pump nor to cut a deeper tunnel. It is said that there is a large deposit of good pay quartz, 40 feet deep and 80 feet long, under the drift, on a level with the tunnel.

The vein is from 8 inches to 2½ feet in width, with slate walls. There are two pay chutes, which were worked to a depth of 160 feet and for a horizontal distance of 150 feet. One account says that the last workings were in a place where the vein split, and the miners were in the poorer branch. It is reported that a rich cross vein was found, but that the hired miner who found it concealed the fact in the hope that he would some day get possession. About $2,000 have been spent on roads to reach the mine and mill.

Goodwin.—The Goodwin mine, 11 miles eastward from Coulterville, was discovered in 1856. It was worked with arrastras for three years, and then for three years more with an eight-stamp mill, which last paid $50,000 profit, some of the rock yielding $100 per ton. The mine and mill lay idle for four years, and under foreclosure of a mortgage passed into the hands of a creditor, who attempted in vain for several years to sell for $1,500, undertook to work the mine in despair, and almost immediately found a good supply of rock, averaging $50 per ton. The vein runs east and west, and dips to the south. The average thickness is three feet, but in places the lode pinches out. The quartz is a ribbon rock, and all of it pays for working. It is found in chimneys, which dip to the eastward, with an inclination of 70° to the horizon on the upper side, but on the lower side the dip is irregular, the chutes growing longer, horizontally, as they go down. Three pay chimneys have been worked so far, and one of them has pinched out in going down. Both walls are of slate, and there is a black putty gouge a foot thick. A cross tunnel 550 feet long strikes the vein 400 feet below the surface, and the lode might be struck 200 feet lower by a tunnel 600 feet long. The present proprietor is about to put in a pump and hoisting works. The mill has eight wooden-stem stamps, and is driven by water from the north fork of the Mercede. The flume is half a mile long, and, with the dam, cost $1,000. The mouth of the mine is two miles from the mill, to which the ore is hauled on sleds.

Bell & McGrew.—The Bell & McGrew mine is a mile west of Coulterville, on the Malvina lode. Several pockets, yielding from $100 to $1,000, have been found, and a mill with five stamps was built on it, but it failed to pay, and is now idle.

McKenzie.—The McKenzie mine, adjoining, has produced some rock that yielded $20 per ton, but the miners were driven out by water, and the owners, finding they could do nothing without a steam pump, sold their five-stamp mill to Bell & McGrew and stopped work. Portion of the mine has caved in.

Hidely & Cunningham.—The mine of Hidely & Cunningham, on the Malvina vein, two miles west of Coulterville, contains a deposit of auriferous talcose slate 15 feet wide, without walls, and some of it prospects very well. There is a four-stamp mill, which was running in May.

Mary Harrison.—The Mary Harrison mine, about two miles southeastward from Coulterville, is situated on a spur from the mother lode. This spur vein is from 3 to 20 feet thick, and the quartz contains talcose slate seams which usually are parallel with the walls, and the seams, or sides of them, contain the most pay. The mine has been worked by an incline 240 feet deep, and a pay chimney 200 feet long, horizontally, has been worked out to a depth of 150 feet. There is no gouge, and the galleries are driven in the slate on the hanging wall side.

The Mary Harrison Company have a claim on the Malvina vein, a mile and a half distant, and they have worked it to a depth of 440 feet from the croppings, and have run 330 feet on the lode. Access is obtained through a cross tunnel. There is black talcose slate on both sides of the vein, which is parallel with the mother lode, and has been traced 4 miles. The gold-bearing portion of the rock is a hard ribbon quartz, near the walls; while in the middle there is soft, shelly, white, barren quartz. The pay chute is 150 feet long, horizontally, and it dips 60° to the southeast on the upper side; the lower side being less regular. There are two mills; one of 35 stamps, the other 15, and the former was about to start at the end of May.

Crown Lead.—Immediately north of the Mercede river, in the line of the Mother lode, is the claim of the Crown Lead Company, which, 10,500 feet in all, is on the Mother, Adelaide, and Medas veins. The Adelaide vein has supplied 1,800 tons, yielding $7 per ton, and this ought to have yielded a profit; but it did not, and the work stopped. The general opinion in the neighborhood is that the mine has an immense quantity of good pay rock, but that it has not been properly managed. The claim extends from the river over a steep hill 2,000 feet high, so that by means of tunnels all the rock could be run out to that depth without hoisting.

The mill on the bank of the Mercede has 20 stamps, and was built in 1864, at an expense of $35,000. The dam cost $30,000, but was bought by the Crown Lead Company for $12,000. It is now in excellent condition. The roads on the claim cost $9,000. Both mine and mill are idle. The mill is provided with Hepburn & Peterson's pans.

Adjoining the claim of the Crown Lead, or on the same ground, is a claim taken up for a copper mine by the Tone Company, which spent $22,000 there and got no return.

Hites Cove.—Hites Cove mine is 30 miles northeast from Mariposa, on a vein which runs northwest and southeast, and is very irregular in thickness, the thickest part being eight feet. The quartz is a ribbon rock, with seams of black matter, which sticks in the skin, so that the workmen in the mine get a very sooty look. All the quartz pays very evenly, and no specimens are found. The average yield is about $150 per ton. The mine has been worked five years steadily, and the present supply of quartz is obtained from a depth of 300 feet. Connected with the mine is a 10-stamp water mill, and all the sands, after passing over copper-plate, are run through arrastras.

Bridgeport.—The Bridgeport mine, just outside of the line of the Mariposa grant, has produced some good ore; but the thickness of the vein (from six inches to four feet) is very irregular, and so is the quality of the rock. The walls are granite; the mill has eight stamps. Both mine and mill are idle.

Peñon Blanco.—The Peñon Blanco mine, 6,000 feet long, two miles northward from Coulterville, takes in nearly the whole of the prominent Peñon Blanco hill. It is being explored by a tunnel which, entering the hill on the south side, strikes the lode 175 feet from the mouth and 100 feet below the croppings. Another tunnel entering the hill on the northwest side is in 285 feet, but has not reached the vein. Two shafts are also being sunk 2,000 feet apart. The south shaft is 25 feet deep in a pay chimney, which yields rock four feet in thickness, averaging $10 per ton. The horizontal length of this chimney is not ascertained, but open cuts on the croppings 200 feet distant are in the same kind of rock, and probably in the same chimney. The north shaft has not struck the vein, but the croppings near this shaft contain about two feet of rock that yields $12 per ton. The first application for a patent under the act of 1866 was made for this mine.

SECTION IV.

TUOLUMNE COUNTY.

Tuolumne county extends from the Stanislaus river on the north to the divide between the Tuolumne and Mercede on the south, and from the summit of the Sierra to the low foot hills near the plains. Nearly all the mines and population are in the western half of the county, below the level of 2,000 feet above the sea.

The placer mines have nearly all been quite shallow, and they are now exhausted in many places. There never have been any large and profitable hydraulic claims in the county, although there are some gravel ridges above Big Oak Flat, and others near Cherokee that may prove valuable for hydraulic mining. One of the chief mining features is table mountain, which follows the Stanislaus river from Columbia to Knight's Ferry, and covers a rich auriferous channel that is worked through tunnels.

This mountain has yielded about $2,000,000, but at a cost of $3,000,000 Another remarkable feature of the county is the limestone belt, which crosses the country, through Garrote No. 2, Kincaid Flat, Shaw's Flat, Springfield, and Columbia. This limestone, instead of having a smooth solid surface, appears to be broken into water-worn boulders, and rich auriferous gravel is found down to a great depth in the narrow crevices between them. In this county, too, the mother lode is more strongly marked; more distinctly traceable for a considerable distance, and worked in more mines than in any other county. Columbia is notable for having produced more large nuggets than any other district in the State, and also for the high fineness of its dust. Bald mountain, near Sonora, has had an unsurpassed cluster of rich pocket lodes, and the Soulsby district has some of the richest granite mines of the State. The county has further extensive and valuable beds of plumbago and some fine white marble suitable for statuary, but its extent is not yet proved.

Much work is being done in prospecting quartz veins, but the advance in lode mining is not equivalent to the decline in placers, and the county has lost about 200 voters annually for six or eight years.

The State and county taxes together are $4 88 on every hundred dollars, or nearly five per cent., and in addition to that there is in Sonora a city tax of one per cent.

The placer mining portion of the county is in a district of hills, neither very high nor very steep, and consequently it is pretty well suited, so far as grade is concerned, for roads and for tillage; but the soil is not strong and water is dear. Grain does not yield large crops, and the supply of fruit far exceeds the home demand, but transportation is so dear that it cannot be taken away fresh with a profit. Large quantities are dried, and in 1866 300 tons of dried peaches were shipped from Tuolumne. Casks and freight are so dear that wine making yields no profit, and the brandy tax prevents the conversion of the grapes into brandy, and many of the vineyards and orchards are not cultivated, and no new vineyards are being planted. The general appearance of the ranches does not indicate prosperity.*

During the first half of 1867 not less than a thousand Chinamen left the county, more than 300 having gone from Columbia and vicinity, and as many more from Chinese Camp.

According to observations made by Doctor Snell in the rainy season of 1861–'62, 121 inches of rain fell at Sonora; in that of 1864–'65, 20 inches; in that of 1865–'66, 35 inches; and in that of 1866–'67, 50 inches.

The following mean thermometrical observations are also taken from his books, the degrees being Fahrenheit's:

	6 A. M.	12 M.	6 P. M.
1858.—October	53°	63°	56°
November	54	61	52
December	43	50	44
1859.—January	46	55	48
February	38	50	44
March	61	81	68

COLUMBIA.—Columbia, situated where the Table Mountain channel crossed the limestone belt, and where the volcanic material had been deroded, having the rich auriferous deposit near the surface, was for a long time the largest and the busiest town in the southern mines. The site was in a beautiful vale, and the town was built up in very neat style, but the placers of the vicinity are approaching exhaustion, business has declined, and many of the lots have been mined out, leaving the large limestone boulders lying naked, barren and cheerless. As the population has declined, houses have lost their value, and dwellings can be purchased for one-tenth their cost. In many cases miners have purchased houses, even brick stores, for the purpose of tearing them down and washing away the dirt of the lots; and this system is still in progress, continually reducing the number of houses, and the area of soil and level ground suitable for occupation. Most of the rich placer claims are in a basin, which has never been drained, and consequently there is a large mass of auriferous dirt that may be worked in the future if drainage is supplied. The Stanislaus river is two miles off, and by starting from a ravine that puts into the river a tunnel could be run 400 feet under the town with the length of a mile and a half. The expense, however, would be very great, and the profit uncertain, so nobody speaks seriously of the project. At the deeper claims in Columbia, the dirt is hoisted from the bottom to a dump box placed so high that there is fall enough from it to carry away the refuse dirt through sluices. The water is thrown upon the dirt in these dump boxes through hydraulic pipes, a style of washing used in very few places in the State.

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* NOTE.—Referring to the advantages to be derived from the construction of the proposed Stockton and Copperopolis railroad, and the impetus that would be given to the industry of the interior counties by this enterprise, Mr. William S. Watson, the intelligent engineer, says:

"The proposed road will not touch Tuolumne county, but for all practical purposes will command its trade and travel, Copperopolis being 15 miles from Sonora, and from Knight's Ferry it is about two miles to the west line of the county. The sectional area of Tuolumne is 1,430 square miles. The character of the country is of course mountainous, forming spurs of the main ridges of the Sierra Nevada, descending into the valley to the west. The population in 1860 was 16,229; assessed valuation in 1865, $1,536,258. The present freights are principally up, amounting to 6,000 tons per year, chiefly supplies; estimated freights to Big Oak Flat, Chinese Camp, Don Pedro's Bar, and the Garrotes, 950; total up freights through Tuolumne county, 6,950 tons; and of down freights, consisting of building materials, lumber, and ores, not less than 1,320; total, 8,270 tons."

From 1853 to 1857 Columbia shipped $100,000 weekly; now the shipment is from $40,000 to $50,000 per month, and there is a steady decrease.

The following are the principal claims in the Columbia basin:

The Columbia Boys' claim, 500 by 100 feet, has been worked regularly since 1850. Previous to 1853 it paid $20 per day; from 1853 to 1857 $7 50 per day, and since 1857 $3 per day. The dirt is hoisted by a wooden wheel. Five men are employed in the claim now.

The Tiger claim, 400 by 130 feet, was opened in 1849, but did not pay much for the first six years. Between 1855 and 1858, however, it was very profitable, and from 1863 to 1865 it paid still better than before. In 1863 the yield was from $100 to $600 per week to the man. It has not been paying expenses for the last two years. An iron wheel is used for hoisting. In the bottom of this claim is a hole leading into a subterranean channel which has its outlet below Jamestown, eight miles distant. On one occasion 2,500 inches of water ran down the hole for weeks; and the same water escaped at the outlet, where the stream was governed as to its size and color by the supply at Columbia. A similar hole is found in a claim at Knapp's ranch. Men have climbed down 150 feet, and gone 100 feet further with ropes to the bottom, where there is a stream 4 feet wide and 12 feet deep, with a slow current and clear water, no matter how muddy the streams may be on the surface. It is supposed that the outlet is at Springfield or Gold Springs.

The Cascade claim, 300 by 150 feet, has paid well for short periods, but has not yielded more on an average than $2 50 per day to the man. Five men are employed, and a hydraulic wheel is used for hoisting.

The McInroe claim, 300 by 100 feet, paid well in early days, but does not yield more than $2 50 per day now to the man. Three men are employed in the claim. The hoisting is done by a whim.

The Burns claim, 400 by 200 feet, paid $10 per day to the hand from 1853 to 1857, and averaged $100 per month to the hand since 1857. Five men are employed, and an overshot wheel is used for hoisting.

The Main claim, 300 by 200 feet, has paid high at times, but does not yield more than $2 per day to the six men employed. The hoisting is done by an iron hydraulic wheel.

The Millington claim, 300 by 100 feet, washes in a ground sluice, and has paid $20 per week over expenses. Four men are employed.

KNAPP'S RANCH.—Adjoining Columbia on the east is Knapp's ranch, of which about five acres have been washed, yielding $40,000 per acre or $200,000 in all. The bed rock here is limestone, but the boulders are large, and the miners can wash between them much more conveniently than among the smaller boulders of Columbia.

The following claims are on Knapp's ranch:

The Sullivan claim, 200 by 100 feet, is fifty feet deep, and is worked by a hydraulic stream thrown against the bank. Two men work the claim, and they make together about $5 per day.

The Peabody and Arnold claim, 200 by 100 feet, is also worked by a hydraulic stream against the bank, which is 50 feet high. No men are engaged in it, and they have at times got very good pay.

The German claim, 200 by 100 feet, has paid tolerably well.

The Grant claim, 200 by 100 feet, commenced working only a short time since.

The Hunt claim, 500 by 500 feet, is remarkably rich. It paid $25,000 in one summer. It employs six men, hoists by hydraulic wheel, and washes in a dump box.

The Dutch Bill claim, 200 by 100 feet, was opened in 1860, and has at times paid $1,000 per month. It yields $3 per day each now to two men. The dirt is washed on the ground.

SAWMILL FLAT.—The following claims are at Sawmill Flat:

The Foley claim, 200 feet square, was opened in 1850, and has never paid more than moderate wages. Four men are employed, and there is a hydraulic wheel for hoisting.

The Dryden claim, 400 by 100 feet, washes in a ground sluice and pays well. It has lately yielded $2,500 to the man in a season. Five men are employed.

SHAW'S FLAT.—Shaw's Flat and Springfield are on the limestone belt, but the deposit of gravel was shallow, and it has nearly all been washed away. At Springfield there are two large springs from which the town took its name; and to these miners brought the dirt in carts in 1850 and 1851, and washed out from $10 to $20 per day. As many as 150 carts were running at one time. There were single cart-loads that paid as much as $1,000. The ground was covered with a heavy growth of large pine timber, which has now all disappeared, and little remains save the rugged limestone. Springfield at one time had 600 voters, and now it has not one-tenth of that number.

At Sawmill Flat, near Columbia, the dirt is hoisted by wheel into a dump box and there washed. The diggings here will last for a long time.

At Brown's Flat they wash in the same manner.

At Yankee Hill there are some rich hydraulic claims.

SONORA.—Sonora is situated on the slate, just below the limestone, and was wonderfully rich in early days, but is now nearly exhausted. The gold shipped nearly all came from placers previous to 1858; now it is about equally divided between quartz and placers. The amount shipped in May, 1865, was $80,000; in June, $84,000; in July, $95,000; in August, $102,000; in September, $91,000.

BIG OAK FLAT.—Big Oak Flat is on a granite bed rock, and the gravel on it was from 2 to 20 feet deep. Ditch water was not brought in until 1859, and in the next year it saw its best days. It is now pretty well worked out.

KINCAID FLAT.—Kincaid Flat, four miles east-southeast of Sonora, 150 feet above the level of Sullivan's creek, on the limestone belt, was formerly a basin of 200 acres; but it has been worked continuously since 1850. The deepest workings are 75 feet below the original surface, but the bottom has not yet been reached on account of the abundance of water and lack of drainage. The richest pay has been found near the water-level. One claim 50 feet square paid $100,000, and it is estimated that the total yield of the flat has not been less than $2,000,000. There is a considerable area of rich ground that cannot be washed until some artificial drainage is supplied, and it has been estimated that by making an open cut 500 feet long and a tunnel 1,000 feet, at a total cost of $12,000, 75 acres might be worked. In addition to the cutting of the tunnel, the flume would be expensive, and a company has been formed with a capital stock of $30,000 to undertake the work.

JAMESTOWN.—Jamestown, on the bank of Wood's creek, was built up by rich and shallow placers in its neighborhood; but these are now nearly exhausted, and the town has become a little village. It is, however, situated near the northern lode, and it will, probably, with the development of quartz mining, recover its prosperity.

OTHER TOWNS.—Algerine, a mile and a half north of the Tuolumne river, and west of the main limestone belt, once had 800 voters, but is now reduced to a few score, the placers on which it depended being nearly exhausted.

Cherokee and Somerville, about eight miles east of Sonora, are on the granite, and they depend mainly on quartz mines for their support.

Chinese Camp and Montezuma are placer mining towns near the western border of the county.

TABLE MOUNTAIN.—One of the most remarkable features of Tuolumne county is Table mountain, which attracts attention from remote distances by its black, bare, level surface, extending across the landscape like a gigantic wall. Examined closely, it appears to be a mountain capped with basalt, a quarter of a mile wide and 40 miles long. It poured out of a volcano near Silver mountain, in Alpine county, and took the same general course as the present Stanislaus river, which has cut across it in various places. There is a fork in the basaltic stream, 14 miles above Columbia. The average height above the adjacent ground in Tuolumne county is from 500 to 800 feet on the northern side, and from 200 to 500 on the southern. The adjacent earth has been washed away to a greater depth near the line of the mountain along its northern base, and for that reason nearly all the tunnels run in on the northern side.

The main strata of the mountain, commencing at the top, are: basalt, which is in most places 140 feet deep; under that is a stratum of volcanic sand 100 feet; then pipe clay and sand, 50 feet; then coarse gravel, 20 feet; then pay gravel, 5 feet; then bed rock. These strata vary greatly in thickness, however, in different places; there are spots where the pipe clay is 100 feet deep; but the above figures are given as an average.

The pay gravel is found in two places; there are really two channels, and whether they were the beds of two different streams or two beds of the same stream, occupied at different times, is not clearly determined, although the latter supposition is the more probable. The channels are not found under the middle of the mountain at every point; there are places where one of the channels is not covered by the basalt at all, and the other is only under the edge of it.*

In a claim near Whimtown a tree standing erect 100 feet high was found in the pipe clay, and it looked as if it had never been moved from the position in which it grew; but it was all charred, though the basalt was a hundred yards distant.

Table mountain has been an unfortunate locality for miners. It is estimated that at least $1,000,000 more have been put into the mountain, counting the regular wages, than were ever taken out. Nine-tenths of the miners who undertook to work claims there were the losers. There was enough gold to pay well, but the miners did not know how to get it. They worked in companies, and many of the members were shirks and idlers. They had no experience in this kind of mining, and did not know how to manage so as to do the most execution with the least labor. They guessed at the level of the channel, and started their tunnels too high, so that they could not drain their ground, and either had great expenses for pumping or had to cut new tunnels. The old channel, when first discovered, was extremely rich, and it was presumed that the possession of a claim anywhere on the mountain was equivalent to a fortune; so no economy was used. Two companies side by side might have united to cut one tunnel, but, instead of that, each made its run. But the outsiders who did not get claims when the mountain was first taken up, in claims 300 feet in length, running across the channel, held a meeting and resolved that those claims were too large, and no man should hold more than 100 feet square. These jumpers, as they were called, far outnumbered the original locators, and they took up a large part of the mountain, held their own for a long time, and spent large sums in prospecting, but were at last defeated in court and ejected. Not one of them made anything by the jumping operation, and it is now conceded that the 300 feet, instead of being too much, was too little, since most who held even those large claims lost money by them.

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* Mr. J. Arthur Phillips says, in his recent work on the mining and metallurgy of gold and silver: "The summit of this elevation is occupied by a thick bed of basalt, of a very dark color and great density of texture, which is occasionally distinctly columnar, and appears to have been poured out in one continuous flow. This, in the neighborhood of Sonora, is from 140 to 150 feet in thickness, and its width near the entrance of the Buckeye tunnel is about 1,700 feet. Beneath this capping of basaltic lava is a heavy deposit of detrital matter distinctly stratified in almost horizontal beds, but with a slight inclination from either side side towards the centre of the mass. These sedimentary beds chiefly consist of a rather fine-grained sandstone, which rapidly disintegrates on exposure to the atmosphere. Interstratified with this sandstone, and more particularly in the proximate vicinity of the bed-rock, are clays and fine argillaceous shales, frequently nearly white and often beautifully laminated. With these are associated beds made up of coarse grain, strongly cohering together, forming the *cement* of the mines; and at the bottom is found the *pay gravel*, exactly like that seen in the bed of an ordinary river. The entire thickness of this detrital mass at its greatest depth is at least two hundred feet. This thickness, however, diminishes towards the extremities of the deposit, where the edges of the basin formed by the rim-rock gradually rise." (Pp. 43, 44.)

The old channel was discovered at Springfield in 1852, in the Fox claim, in a shaft eight feet deep, on a flat from which the basalt had been washed away. The next year the Berry shaft, 55 feet deep, struck the channel; but it was not till the first of May, 1854, that the first tunnel was started, and the theory of lead running under the basalt was generally considered absurd until October, 1855, when the first tunnel reached the channel under the basalt.

The tunnels, to reach the channel, average about 1,000 feet in length, and the present cost of cutting tunnels at Table mountain is $16 per lineal foot. The common size of the tunnel is six feet high and four feet wide. The grade is one foot in a hundred. At the bottom of the tunnel is laid a tramway, 28 inches wide. Sleepers, three by four inches, rest on ties of the same size four feet apart, and are covered with iron straps an inch and a half wide and a quarter of an inch thick.

The following is a list of the claims in Table mountain, with a brief statement of their success and present condition, commencing near Columbia and running down stream:

The Buchanan claim, 300 feet long, has a tunnel which never paid expenses nor reached the gravel; it is not working now.

The Springfield claim, 2,000 feet long, has a tunnel 1,500 feet long, and paid well. The claim is working now. Three channels were found in this claim, and all were rich.

The Joint Stock claim, 2,400 feet long, has one tunnel of 1,000 feet and another of 1,200, that was commenced in 1855; and the claim is not abandoned, although $150,000 have been spent on it and only $50,000 taken out. Good gravel has lately been found, and the claim is considered valuable.

The Saratoga claim, 1,200 feet long, has a tunnel 1,200 feet long. The yield was $300,000, but rumor says the expenditures were still greater. The first owners sold out at a high price, making a profit by speculation, but causing so much more loss to the purchasers. The claim is not working now.

Here comes a gap in the mountain, and below are the following claims:

The Crystal Spring claim, 800 feet long, reached the channel and produced much gold, but the sum was not ascertainable; it is standing idle now.

The Know-Nothing, a jumper claim, never reached the channel.

The Gold Hunter, a jumper claim, never reached the channel.

The Virginia claim, 1,700 feet long, reached the channel with a tunnel 800 feet long, but took out only $5,000 and spent $100,000. The company had very long and costly litigation with jumpers on both sides.

The Blank jumper company started a tunnel on the Virginia ground, but never reached the channel.

The Independence jumper company reached the channel by a tunnel 500 feet long, but found no gravel, and lost $75,000 by their enterprise.

The Mary Ann, another jumper company, ran a tunnel in a considerable distance, but found nothing.

The Cape Cod, also a jumper, had similar bad luck.

The American claim, 1,600 feet long, has a tunnel 900 feet long, and cut across the channel with a drift five feet wide. No pay gravel was found here, and the company were so poor and so much discouraged that, instead of examining the channel further, at a slight expense, as they could have done, they stopped work, and nothing has been done now for three years. Their loss was $30,000.

The Buckeye claim, 1,000 feet long, now includes several old claims, and has three tunnels, only one of which, 2,000 feet long, is now used. One of the abandoned tunnels was 1,650 feet long. Work was commenced in 1854, and has been kept up, with the exception of one year, ever since, at an expense of $100,000, while the total yield has been only $10,000. An artesian auger was used in prospecting this claim, and Mr. Gould, who tried the experiment, thinks it should be used frequently. His drill was four and a half inches wide, and he bored four or five feet in basalt and eight or ten feet in slate in 12 hours. The cost in slate is $6 or $8 per foot. A water blast is used for ventilation.

The Boston claim, 3,000 feet long, commenced work in 1855, and has worked steadily ever since. The total yield has been not less than $500,000, and the total net profit nothing. Much of the work was done at first by a joint stock company, the shareholders in which claimed the right of being employed, though some of them were of little value as laborers. The manager did not know how to work to advantage, and did not pursue any steady plan. They worked first in one place and then in another, without exhausting either, and then the timber rolled and the roof fell in. There are now two owners in the claim, and they are doing better than any of their predecessors, though the gravel is not so rich as it was some years ago. There is still a large amount of ground untouched. Ten men are employed, and there is pay dirt enough in sight to keep them busy for half a year. The average yield per day is $8 to the man, or $1 per ton. The dirt is soaked over night in a dump-box before.

The Maine Boys' claim is 1,200 feet long on the north side of the mountain, but the lines converge so that they are only 550 feet apart on the south side. The expenses have been $120,000, and the yield very little. The original shareholders, having starved themselves out, sold conditionally to a San Francisco company.

The Scraperville claim, 1,200 feet, has paid. It is said that the owners of one-fourth of the stock saved $5,000 in a few years.

The Oliver claim, 4,000 feet long, has yielded $200,000, and report says $8,000 have been taken from a single dump-box, which holds 150 tons. The profits were moderate till the end of 1866, and are now large. This company has been engaged in litigation for six years, has spent $30,000 on the suit, and has been before the Supreme Court, in one form or another, with it four times. The company is working the side channel.

The New York Company claims 2,400 feet, and their ground is considered the richest in the county. They are working on the side channel, which is there about 60 feet wide, and each longitudinal foot on it pays $1,000. They say they have taken out $250,000; others say $300,000.

The Chinese claim, so called because the shareholders came from a Chinese camp near by, is 2,000 feet long, and never paid anything. The tunnel was run in 300 feet.

The App claim, 2,000 feet long, has a tunnel 1,500 feet long, cut at a cost of $50,000. It never paid anything.

The Know Nothing claim, 1,500 feet, has yielded nothing and swallowed up $7,000.

The Chicken Company claimed 2,500 feet, spent $20,000, cut two tunnels, and got nothing.

The Montezuma Company claimed 3,000 feet and sunk $20,000 in a tunnel 2,000 feet long.

The Rough and Ready Company claims 5,400 feet, and have taken out not less than $200,000. One of the shareholders observing some gravel on the mountain side, filled his pan with it, and on washing it found a good prospect. They set to work here and found it rich. It was a bar of the old river, 75 feet above the level of the channel. The claim has been worked regularly since 1854, and still pays a little.

The Union claim, ——— feet, unopened.

The Palisade claim, 5,400 feet, is unopened.

Here we come to a place where the channel is lower than the country on each side of the mountain, so it is impossible to get any drainage or to do any work.

The old Stanislaus Company has a claim 12,000 feet long on Table mountain, just above the point where the Stanislaus river cuts off. The channel where it opens on the bluff is 350 feet above the level of the present river, so there is abundant drainage down the channel, though the country on both sides of the mountain is higher than the old channel. The old Stanislaus Company spent a good deal of money trying to get in from the side before they discovered the outlet on the bluff. Some of the gravel paid $18 per ton. A mill was erected in 1859 to crush the cement, but it did not pay.

At Two Mile Bar (two miles east of Knight's ferry) the channel is 80 feet below the level of the present Stanislaus river.

QUARTZ MINING IN TUOLUMNE.—Tuolumne county is very favorably situated for quartz mining, and so far as external indications and facilities may serve as guides, the presumptions are that it will be second to no other county in California in production of quartz gold. Wood and water are abundant; the roads generally are good, and the quartz veins large, numerous and easily traced. The mother lode and the companion talcose vein here have their largest and most regular development. The Golden Rule, the Reist, the Mooney, and the Heslep are all in the companion talcose vein, and have paid for a longer time than any other of their class in the State. The quartz veins in the granite about Soulsbyville are the most productive of their class in the State, and the cluster of pocket mines on Bald mountain is unsurpassed in the multitude and richness of pockets within a small area.

GOLDEN RULE.—The Golden Rule, 1,600 feet long, is on the mother lode, about three miles eastward from Jamestown. The claim includes both veins, the main mother lode, and the talcose slate branch or companion vein. At the surface they are 75 feet apart, and 87 feet below they are 40 feet apart. The main lode is 12 feet thick, exclusive of a horse, and the slate vein is eight feet. The latter is the one which is being worked. The vein is a black slate, bearing much resemblance to ordinary roofing slate, and is penetrated in every direction by seams of quartz, seldom more than two inches in thickness. The gold is found in the slate, seldom in the quartz. All the vein-stone is worked, though that near the foot wall is the richest. The rock is soft, and is easily extracted and crushed. The pulp from the battery is black like the slate. The walls are a hard magnesian rock. There is a slight dip to the east. The mill has 15 stamps, and is driven by water. The weight of the stamps is 750 pounds, their speed 50 blows per minute, and their drop from five to eight inches. There is sufficient power to drive 15 stamps more. The water is obtained from the Columbia Ditch Company. About 85 per cent. of the gold is caught in the mortar, and nearly five per cent. on the copper plates immediately below. The pulp runs over a shaking table, which has 120 jerks per minute, and is cleaned out twice in 24 hours, yielding about 400 pounds of sulphurets each time. The pulp also passes over blankets, which are washed once in an hour. There are 10 pounds of pure sulphurets to a ton, but the concentrated tailings as saved are about 40 pounds to a ton of ore, and there are $40 per ton in these tailings, which are worked in an arrastra, which pays six ounces a month. A Stetson amalgamator below the blankets pays only $1 per month.

The slate vein was brown and decomposed at the surface, and was washed in sluices by placer miners to a depth of 30 feet. In 1866 the present mill was finished, and in the year preceding the 1st of July, 1867, the number of tons crushed was 4,099; the average yield per ton, $8 94; the total yield, $36,653;

cost of labor, $16,500; cost of repairs, timber, lumber, charcoal, hauling, taxes, &c., $5,800; cost of supplies sent from San Francisco, $2,400; office expenses in San Francisco, including salaries of president and secretary, freight in bullion, travelling expenses, &c., $1,500; dividends, $7,500, and cash on hand, $2,953. The total expenses were $6 39, and the net profit $2 55 per pon. The average number of days that the mill ran in a month was 23; the highest being 27, and the lowest 17. The average yield per ton was $5 71 in March, $6 79 in January, $6 97 in June, $7 72 in November, $15 54 in October, and $10 or $11 and odd cents in the other months. The number of men employed was 16, of whom 8 were miners, 2 carmen, 4 millmen, a blacksmith and a superintendent.

The rock is extracted through a tunnel 400 feet long, 80 feet below the summit of the hill, and 500 feet above the level of Sullivan's creek, below which the mine cannot be drained by a tunnel.

App.—The App mine is 1,000 feet long on the mother lode, near Jamestown. The vein there is nine feet wide on an average. The vein-stone is quartz, in places white, in others greenish, and others dark. The richest spots are near the walls. The vein dips about two feet and a half in ten. The hanging wall is magnesian rock, and the foot wall slate. At the surface there were three pay chimneys, 75, 100 and 125 feet in horizontal length respectively, separated by intervals of 60 and 35 feet, with a dip to the northwestward of 70° on the upper side, but widening out on the under side, and at 180 feet the three had united in one chimney 235 feet long horizontally. Horizontal sections of the chimneys would represent not rectangles but quadrangular parallellograms, with two very acute angles. The chimneys have not run out in any place, but in several places the walls have pinched close together, so that there were only seven inches of quartz. In these spots the chimneys were of the same richness to the ton as elsewhere. The distribution of gold in each chimney is very even in relation to the depth; but on any given level the most gold is found at the sharp ends, and the least in the middle of the chimney. Each chimney, however, has its peculiar quartz. One chimney has white quartz, another greenish, another bluish, and the last is the richest. The gold is fine, and seldom visible in the quartz. The present supply of rock is obtained at a depth of 300 feet, and the shaft is now being sunk deeper. The working level is 300 feet long, and the supply of pay quartz in sight will last two years for the present mill, which has ten stamps, and is driven by water. In 1866, 1,800 tons were worked, and the average yield was $14 55 per ton; from 1863 to 1866, inclusive, four years, 7,200 tons were worked, and the average yield was $15. The pulp as it comes from the battery is ground in charges of 400 or 500 pounds for three or four hours in various pans, without quicksilver, and two pan charges are amalgamated in a separator for the same length of time. The yield in the pan is about $6 per ton. The total expense per ton in this mine is about $8 per ton, and in the mine alone $4 50. The wall is in places as smooth as glass, and the gouge is thickest at the pay chimneys.

Silver.—The Silver or Anthrax mine, 1,500 feet on the mother lode, is being opened in good style. There is a 10-stamp mill, which was idle in May and waiting for the complete opening of the mine. The companion talcose vein strikes the main lode 400 feet from the south end of the claim, runs with it, but as a distinct vein for some distance towards the north, then diverges again, and at the northern end of the claim the two are six feet apart. The companion vein, so far as examined, is barren here.

Heslep.—The Heslep mine, 1,650 feet on the companion talcose vein, has been worked 1,200 feet on the surface, and has paid all the way. The pay matter is decomposed quartz and slate, of a tan color, and soft enough to be picked out, and in some places to be shovelled without picking. The cost of working is estimated at $2 50 per ton. The vein varies in width from 8 to 20 feet. The deepest workings are 90 feet down. The mill has ten stamps, which are driven by an overshot wheel 30 feet in diameter and four feet wide. The power is furnished by 80 inches of water, which costs $50 per week, and is used over again by the Golden Rule mill, which pays half the water bill. The yield of the Heslep rock is $8 per ton.

TRIO.—The Trio mine, 2,316 feet long on the mother lode, on Whisky Hill, is doing nothing now. A ten-stamp mill was erected, and four shafts and two tunnels were begun, but the rock taken out paid only $4 75 per ton, and the mine and mill are now standing idle.

REIST.—The Reist mine, 1,000 feet in the talcose companion vein, is considered generally to be one of the best mines in Tuolumne county, though it has been worked on a very small scale and has never paid much profit. The pay rock is decomposed matter like that in the Mooney mine, but it pays better.

MOONEY.—The Mooney mine, 600 feet on the mother lode, near Jamestown, is on the talcose vein, 40 feet east of the main lode. The material is a tan-colored ochrous earth, mixed with slate and quartz. It pays $4 75 per ton, and a stamp will crush about three tons per day. Much of it has been sluiced away. There are occasional rich pockets in it. A four-stamp mill is now at work, and the rock for it is obtained from an open cut 200 feet long, 40 feet wide, and 60 feet deep. There are no walls, apparently. At the bottom of this cut some hard quartz has been found.

RAW HIDE.—Raw Hide mine, 1,650 feet long on the mother lode, where it is 12 feet wide. A depth of 280 feet from the surface has been reached, and a level has been run 80 feet on the vein. The quartz is colored green with carbonate of copper, and it yields from $7 to $44 per ton. The mill, containing 20 stamps, a 40-horse power engine, and fine hoisting works, is considered one of the best in the southern mines. The rock is crushed to the size of a pigeon's egg or smaller in a Brodie's crusher before going to the stamps. There are 10 Wheeler's pans, and five 8-foot settlers. Thirty tons of quartz are crushed in 24 hours. The shaft is kept clear of water by hoisting it in tubs holding 160 gallons each. The hanging wall is slate, and the foot wall serpentine, with asbestos in it.

EAGLE.—The Eagle mine, on the mother lode, 1,000 feet long, has a 10-stamp mill, and the yield is $18 per ton. The present supply of quartz is obtained 120 feet below the surface, through a tunnel. The mine was purchased several years ago by eastern capitalists for $300,000.

SHAROMUT.—The Sharomut, on the mother lode, has a 10-stamp mill, which is idle.

CLIO.—The Clio, 2,000 feet, on the mother lode, has a 10-stamp mill and has been at work five or six years, but is now idle because the dam which supplied water to drive the mill was carried away by the flood of last winter.

MEADER AND CARRINGTON.—The Meader and Carrington mine, 1,500 feet, on the mother lode, has been opened to a depth of 140 feet, where the water became troublesome and work was stopped. Some good pay quartz was found. There is a four-stamp mill which was used for a time for custom work, but is now idle.

PATTERSON.—The Patterson mine, 1,950 feet, on a branch of the mother lode, near Tuttletown, has been worked for ten years. The vein is from 3 to 15 feet wide. The pay was very good for 75 feet from the surface, but not so good below the water level. The deepest workings are 100 feet down. The quartz is extracted through a tunnel. The rock contains large cubes of sulphuret of iron, some of them an inch and a half square, with free gold in the heart of the cubes. There is an old 10-stamp mill, driven by 40 inches of water on an overshot wheel. Only five of the stamps are now running.

About half a mile westward from the mother lode, near the Patterson mine, a pocket containing $10,000 was found in 1866 by an old man who had a conviction that there was a pocket in the neighborhood, and had spent seven years hunting for it. When he found it he paid the friends upon whom he had been living, and went to the eastern States.

TOLEDO.—The Toledo mine, one mile west of Tuttletown, and half a mile west of the mother lode, has been opened by a shaft 160 feet deep, and drifts running 300 feet on the vein. There are two veins, one 2 feet thick and the other 15 feet, and the two 150 feet apart. Some of the quartz has assayed $300 per ton, but there is much arsenic in it. A 15-stamp mill erected on the mine did not pay, and it was sold and moved to the Golden Rule mine.

The Morse quartz, near Tuttletown, is running and has six stamps.

SOULSBY.—The Soulsby mine, 2,400 feet long, eight miles east of Sonora, is on a lode which runs with the meridian, and dips to the east at an angle of 60° at the north end, and 90° at the south. The thickness is from 4 to 9 inches at the surface; 8 inches at 100 feet, and 18 inches in the deepest workings, 400 feet below the surface. The walls are syenite, and there is a white gouge of clay or slate, seldom more than three-quarters of an inch in thickness. The quartz is bluish, and is heavily charged with blue sulphurets, lead, antimony, arsenic, and zinc; so that the ore bears little resemblance to the auriferous quartz found on the mother lode, and in other gold veins generally. The lode has been worked along a horizontal length of 1,800 feet, and in that distance five pay chimneys have been found, the longest horizontally being 200, and the shortest 15 feet. Most of them dip north at an angle of 60°; and they run to a feather-edge in every direction. In some cases there is a connection of pay between the chutes, and in others there is none. There is very little barren quartz; between the pay chimneys the walls come together, except in a few spots where white quartz or a horse porphyritic rock appears. The vein is marked by slides and cross-courses, which run east, northeast, and southwest, and all, save one, dip to the northwest. These throw the vein to the left, and the one which dips to the southeast throws it to the right. The cross-courses, and the breaks which they have occasioned in the lode, have been among the chief difficulties in working the mine, and its present success is probably owing chiefly to the careful study given by Mr. Inch to the nature of the formation. In a mine of this kind the most important quality in a superintendent is the capacity to find the pay chutes, and as the cross-courses throw them from five to ten feet out of the line, in a very hard granitic rock, the search is slow and expensive. There are dikes of trap cutting through the country, and the miners regard them as good indications, and expect to find pay near where they cross the quartz. Mr. Inch remarked that perhaps they were supporters or feeders of the electro-magnetic or other influences under which the gold was deposited. The mill has 20 stamps, and is driven by water while water can be obtained, and has a steam engine to furnish power in the dry season. The stamps weigh 500 pounds, make 60 blows per minute, and drop from 8 to 12 inches. About 90 per cent. of the gold is caught in the mortar, and 95 per cent. of the remainder on the first copper plate below the screen. The blanket tailings are worked in a chill mill and a Ball's amalgamator; and below these there are other blankets, the tailings of which must go through the same process.

About 50 men are employed at the mine and mill, but nearly all the work is done by contract. Sealed proposals are invited at the beginning of each month to sink a certain shaft a certain number of feet, or to run a drift, or to break down the quartz in a certain slope. With strangers, written contracts are made; with old hands, oral contracts are considered sufficient. There is never any trouble about the contracts. The miners sometimes make bad bargains, but they must keep them or leave the place. The best hands like this system, because it enables them to make more than they could make otherwise. Sometimes they make $150 a month; sometimes not more than $30. Under this system there is no shirking on the part of the men, and no favoritism on the part of the superintendent. Mr. Inch says that, if he had undertaken to pay his men by the day;

the mine would have been a failure; that is, when he commenced his work; but now it is probably in a condition to leave a profit, even if the expenses were 50 per cent. greater than they are.*

The Soulsby mine was discovered in 1858, and between May of that year and March of the next, yielded $80,383 gross, and after the erection of a twenty-stamp mill, $54,416 remained net. It is said that the total yield was $500,000 in the first three years, and that the present monthly yield is from $10,000 to $12,000.

Platt.—The Platt mine, 1,200 feet, lies 1,500 feet south of the Soulsby, and is supposed to be on the same lode; but the ground is intersected by more slides and cross-courses, and the mine, after producing $50,000, was abandoned in consequence of the inability of the superintendent to find the vein at the breaks. Lately, Mr. Inch, superintendent of the Soulsby, has gone to work, hoping, with his experience in the latter, to find the pay in the Platt. Five pay chimneys have been worked. There was a mill on the claim, but it was moved to the State of Nevada during the silver excitement.

Starr King.—The Starr King, 15 miles east-southeast of Sonora, is on a north-and-south vein, which dips 40° east, and has a thickness of six inches at the surface, and 18 inches 120 feet down. It cuts across the dip and the cleavage of the slate, and the walls are a very hard slate. The walls and the quartz resemble those of the Rocky Bar mine, in Nevada county. There are two chutes, which run down almost vertically. The rock yields from $15 to $150 per ton. The mill has five stamps, and the mode of amalgamation is the same as at the Soulsby mill.

Old Gilson.—The Old Gilson mine, 1,200 feet long, adjoining the Platt on the south, was opened to a depth of 125 feet, and to a length on the vein of 250 feet. The rock yields $50, and there was a pay chimney 80 feet long horizontally, but it dipped northwards into the Platt. The mine is now standing idle, and the 10-stamp steam mill is running on custom-work.

Grizzly.—The Grizzly mine, 1,800 feet long, 10 miles eastward from Sonora, near the north fork of the Tuolumne river, is on a vein from 6 to 12 feet wide. The hanging wall is granite; the foot wall slate. There are numerous horses in the lode. The pay is disseminated pretty evenly through the rock, which yields about $20 per ton.

There is a twenty-stamp mill, which commenced work in 1859, and in two years took out $125,000, if rumor be true. The flood of 1862 carried off part of the mill, and stopped work a while, but the mill is now running. In this mill the crushing is dry, and a blower is used to keep the dust from troubling the laborers. The amalgamation is done in 10 Hungarian cast-iron barrels, each 3½ feet long by 2½ wide. The charge for each is 500 or 600 pounds, and enough water is added to make a pulp so thick that in ten minutes after the barrel has started to revolve, small particles of quicksilver will be found in the pulp, which adheres to the finger thrust into the mass. About 50 pounds of quicksilver are put in at a charge. The barrel revolves horizontally with a speed of eight or ten revolutions per minute. After running for seven hours, water is added to thin the pulp, so much that the quicksilver will all settle, and after another hour of revolution the thin pulp is drawn off, and andther charge is put in. All the amalgamation at the Grizzly mill is done in these barrels. There are two iron cylindrical rollers, each three inches in diameter and as long as the barrel inside, and these turn and assist in the amalgamation during the revolutions of the barrels. The barrels are cleaned up once in two weeks. Amalgamation proceeds more readily if hot water is used. Mr. Philip S. McDonald, who was superintendent of the Grizzly mill for a time, and has the repute of being a very competent man, prefers the system of dry crushing and amalgamating in close barrels. By the ordinary modes of crushing and amalgamation much of the fine gold is carried off by the water. In dry crushing, however, it is necessary to protect the laborers from the dust, which has been known to cause death in three months, where no precaution was used.

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* The London Mining Journal refers to the contract system as an essential element of success in the mines of Cornwall. It has also worked admirably in the St. John del Rey mine, in Brazil. The average cost of raising the ore from this mine in 1865, under per diem wages, was $7 87. In 1866, under the contract system, it was only $6 29—an immense saving, considering the vast amount of ore raised. The contract system has been adopted to a considerable extent in the New Almaden quicksilver mine. It cannot of course be made of universal application, so much depends upon local circumstances; but experience has demonstrated that whenever it can be applied, the result has been a great saving in the expense of mining.

The Bonita mine, adjoining the Grizzly on the south, is idle, and so is its 10-stamp mill, which was built before the mine was opened.

The Consuela and its ten-stamp mill are doing nothing.

The Martin mine, two miles south of the Grizzly, is being worked with arrastras.

The Invincible mine, 2,000 feet on Sugar Pine creek, 22 miles eastward from Sonora, has produced some good quartz, but the mine and its mill are standing idle now.

The Excelsior mine, at Sugar Pine, has yielded $300,000, of which two-thirds was profit.

Mount Vernon.—The Mount Vernon mine, 2,100 feet long, 18 miles northeast of Sonora, is on a vein which runs northeast and southwest, dips 45° to the southeast, and is about two feet wide on an average between granite walls. Only one pay chimney has been found, and that dips about 45° to the southwest. It was 60 feet long horizontally, near the surface, and 300 feet down it is more than 100 feet long, the end not having been found in the drift now being run. The rock is worked in the Monitor mill, which is very near on the north fork of the Tuolumne river. The rock pays $96 per ton, and in 1866 500 tons were worked.

Snell.—The Snell mine, 1,800 feet long, 15 miles northeast of Columbia, is on a vein which runs northeast and southwest, is nearly vertical, and has an average width of one foot. A pay chimney was found, and it paid $50 per ton, but it pinched out. A mill is going up now.

Monitor.—The Monitor, 2,100 feet long, 18 miles east of Columbia, in Sugar Pine district, is 15 inches wide, and dips at an angle of 45° to the east between granite walls. There is an incline down 60 feet, and drifts have been run 90 feet on the vein. Some of the rock has paid as much as $300 to the ton, but the mine and mill are both idle now. The mill has five stamps.

Hazel Dell.—The Hazel Dell mine, 1,550 feet long, at Five-mile creek, on a vein that averages about two feet in thickness. The walls are rotten granite. The rock averages $25 to $30, but at present the extraction of quartz is interrupted by water. The lowest workings are seventy feet below the surface. A tunnel is now being cut for the purpose of drainage. There is a five-stamp mill which has been leased.

Summit Pass.—The Summit Pass mine No. 1, one mile from Columbia, 3,600 feet long, runs north and south, dips to the east at an angle of 70°, and is four feet wide. The walls are of slate, with an overlying stratum of limestone near the surface. The claim has been worked 500 feet along the surface, and paid well. The quartz is heavily charged with arsenical sulphurets. No work is being done now.

Summit Pass No. 2, 2,000 feet long, is on a spur from the preceding lode. The mine has been opened at several points.

Quartz near Columbia.—The Columbia mine, on the experimental lode at Summit Pass two miles northeast of Columbia, has limestone walls, runs northwest and southeast, dips to the northeast, and is from one foot to four feet in width. The average pay is $11 per ton. It is worked with a 15-stamp mill.

The Kimball mine, three miles northeast of Columbia, lies between limestone and green-stone, is a foot wide, and is accompanied by a trap dike 8 or 10 feet wide. When first opened $6,000 were obtained from 600 pounds of rock. It is not worked now.

The Kimball extension, adjoining the Kimball, is similar in character, and is being worked now, the quartz being crushed in a custom mill. The yield is $10 per ton.

The Shanghae mine at Yankee Hill, two miles east of Columbia, in a vein which runs north and south, dips to the east at an angle of 65°, and is three feet wide. It is east of the limestone belt in slates highly metamorphosed. It was worked with arrastras in 1856, and yielded then $100 per ton; and it is now worked with a 10-stamp mill.

HUNTER.—The Hunter mine, in Big Cañon, 14 miles southeast of Sonora, is on the side of a mountain that is at an angle of 45° from the north fork of the Tuolumne. The rock was very rich at the surface, and a tunnel run in 20 feet ran through quartz that yielded $300 to the ton. The owner was so delighted that he built a mill without delay and at great cost. The only way to get the timbers and castings to the site was to let them down with ropes from the top of the mountain. After $40,000 had been expended in the mill and in exploration, it was found that the pay chute was only 20 feet long, and more money would be required to work it than the owner could raise; so after $10,000 had been taken out no more work was done.

LEWIS.—The Lewis mine, 2,400 feet long, is 20 miles east-northeast of Sonora, on a vein of talcose slate 150 feet wide. The course is north and south, with a slight dip to the east. The slate is barren, but it encloses a number of veins of quartz which run in every direction, and all are rich. There are several chutes about 30 feet long horizontally, in which the quartz averages $25 to $30 per ton, while elsewhere the quartz yields $10 or $12. Most of the quartz is found near the hanging wall. The vein has been examined for a distance of 2,000 feet, and pay rock has been found at intervals along the whole distance. The quartz in places contains sulphurets of iron and lead, and crude sulphur is found in the slate. Heretofore the quartz has been extracted by tunnels, but hereafter shafts are to be sunk. The eastern wall is granite and the western a hard black slate. The mine lies in the Big basin, which is surrounded by high ridges, on the north side of which the snow lies till May. The rock is crushed in a five-stamp mill, and is amalgamated in two large arrastras. The gold varies in fineness from 600 to 785, the highest fineness being obtained from those quartz veins which contain the coarsest particles of metal.

SELL AND MARTIN.—The Sell and Martin mine, 1,200 feet long, is situated one mile north of Sonora. It is two or three feet wide, and runs northwest and southeast, and dips 60° to the northeast. It is a remarkable pocket vein, and has produced not less than $150,000, of which one-fourth has been profit. It was first opened in 1850, and has been leased three or four times. For one year the lessee paid one-third, and for another one-fourth of the gross yield. About 2,000 tons of rock have been taken out in all, but most of the gold has been pounded out in a hand mortar. The walls are of slate, and the country is intersected by porphyritic dikes three or four feet thick, which occur at intervals of 100 or 150 feet along the 700 feet in which the pockets have been found. The vein is later in formation than the dikes and cuts across them, and on the lines of intersection most, if not all, of the pockets have been found. The quartz, except in the immediate neighborhood of the pockets, is barren. A 15-stamp mill was erected at the mine in 1863, but as no large quantity of ore could be obtained to yield more than 50 cents a ton, the mill has been standing idle. There are several men now at work in the mine hunting for pockets and taking out the gold in a hand mortar when they find them. The largest pocket found yielded $15,000.

Sophia.—The Sophia mine, two miles east of Sonora, is 2,150 feet long, on a vein which runs northeast and southwest and dips 80° southwest. The vein is crossed by dikes which the miners call granite. Their width is usually three feet, though one is forty. The gold is found in pockets near the dikes. Every pay chimney is near a dike, but some of the dikes have no pay chutes near them. The walls are of slate, and there is on one side or the other a talcose gouge, usually on the hanging wall; and when in the foot wall it indicates the proximity of a pocket. There are within a distance of 300 feet, horizontally, three pay chutes, each of them from ten to twenty feet long. The mine has been worked by a tunnel 400 feet long, and a shaft 80 feet deep; and another tunnel 130 feet below the level of the first one is now in 170 feet. The total yield from the mine has been $45,000, and in the year ending May, 1867, the produce was about $5,000. There is a five-stamp mill on the claim, but it has not rock enough to run regularly.

Bald Mountain.—On the same Bald mountain, and it is supposed on the same vein, is the Patterson and Turner claim, which yielded $30,000 in one pocket, and $60,000 in all.

On the same mountain is the Ford claim, which was discovered in 1851, and was wonderfully rich at the surface. One pocket yielded $40,000, and the owners rejected offers to purchase shares at the rate of $500,000 for the entire mine.

The Austrian claim, on the same mountain, had one pocket that paid $70,000, besides several others smaller.

The three claims last mentioned are all idle now, and were worked only near the surface. There is no regular (as distinguished from a "pocket") pay chute in Bald mountain, the gold being nearly all in pockets. The gold is of very fine quality, some of it 960 fine. Some pockets are surrounded by shattered and decomposed rock, and about these some mill rock is obtained, but the pockets in hard rock have all their gold in a little compact cluster.

Bald mountain is only a mile east of the limestone belt which runs through Tuolumne county, and many miners say that all the gold near the limestone is in pockets.

Draper.—The Draper mine, 4,000 feet long, six miles eastward from Sonora, is on a vein which runs north and south, is nearly perpendicular, and is 15 inches wide in granite walls. The lowest workings are 325 feet deep, and they extend 410 feet on the vein. There are three pay chimneys, one of 70, one of 90, and one of 60 feet in horizontal length. Between the pay chimneys the walls pinch together. The mine has been worked regularly since 1858. The quartz yields about $40 per ton, and 150 or 180 tons are extracted monthly and worked in steam custom mills, to which $6 per ton is paid for crushing and amalgamation. The price in water mills is $5 per ton. The ore is heavily charged with sulphurets of iron, copper, lead and zinc.

Nonpareil.—The Nonpareil mine, one mile from Big Oak Flat, is on the Nonpareil vein, which runs east and west and dips to the north at an angle of 70°, and has an average width of five feet. The walls are slate, and the quartz of the veinstone is mixed with slate, and in places the hard slate is seen full of particles of gold. Several shafts have been sunk, and the deepest workings are 140 feet on an incline. Drifts have been run 160 feet on the vein in pay all the way. At 70 feet from the surface the rock yielded $30 and $40 to the ton, but in the lowest levels the pay has been $13. The rock contains five per cent. of sulphurets which assay $300 or more to the ton, some samples yielding double and treble as much. The mine is now troubled with water, and work has been stopped, but a tunnel 650 feet long would drain the mine to a depth of 340 feet. There is a five-stamp mill which is also idle. The power is supplied by a Faucherie turbine wheel seven inches in diameter and four feet long, including the driving wheels. There is 345 feet of perpendicular fall for the water, and 60 inches are used at a cost of 15 cents per inch, or $9 for 24 hours. The turbine was bought with the assurance that it would drive 24 stamps, but the opinion among those who have seen it work is that it would not drive more than 10 Farrand's oscillating pan and Hinkle's pan are used in the amalgamation.

Burns.—The Burns mine, on the Nonpareil vein and adjoining the Nonpareil mine, has a mass of decomposed talcose slate which is in places 25 feet wide. It all pays to work, and 12 tons are rushed daily through the five-stamp mill. Five additional stamps are being put in. The pulp, after being amalgamated in the mortar and on copper plates just below the battery, runs into tanks and settlers, and from the tanks the sand is put into Varney's pans to be ground, and it is afterwards amalgamated in settlers.

Other Quartz near Big Oak.—The Rattlesnake mill containing 10 stamps, erected in 1866 at Big Oak Flat, is not running now.

The Cosmopolite mine, near the head of Garrote creek, is on a vein which runs northwest and southeast and dips to the northeast, and is ten feet wide. The lowest workings are 150 feet below the surface, and a 10-stamp mill, formerly known as the Cross or Anita mill, belongs to the mine.

The Mississippi mine at Big Oak Flat has had some rich pockets. A mill was built in 1866, but it is not running now, crushing being done at present in an arrastra.

The Cross mill is standing idle. It belongs to the Golden Rock Water Company and offers to do custom work.

The Mack mill is also idle. The Jackson mill, four miles east of Big Oak Flat, ditto.

SECTION V.

CALAVERAS COUNTY.

The county of Calaveras extends from the Stanislaus river on the south, to the Mokelumne on the north, and from the summit of the Sierras on the east, to near the base of the foot-hills on the west. The rivers which serve as the northern and southern boundaries are permanent, but all within the limits of the county, unless streams confined to the snow regions near the summit, go dry in summer. The Calaveras river, from which the county takes its name, and the San Antonio, are considerable streams in winter, but their beds are bare in the fall.

With the exception of West Point, all the towns of any note in this county are on the lime belt, or west of it; and most of them are within 1,800 of the level of the sea, and in a region which, except near the large streams, is gently undulating, so that there is little difficulty in travelling about. All the streams are auriferous, but most of the diggings have been shallow and are now exhausted, and as a consequence the business of the county has very much declined. There is not one large hydraulic claim in the county, and although there are many quartz claims that have each yielded large sums, there is no quartz mine that has paid high and constantly for five years. There is good reason to believe, however, that Calaveras will, in a few years, occupy a much higher position in quartz mining than at present. The county is well supplied with water by ditches; the roads are comparatively good; and timber can be had in sufficient quantity for mining purposes.

The debt of the county is $240,000, and the State and county tax is four per cent. annually of the assessed value of property.

There are fifteen ditches in the county, with a total length of 300 miles, constructed at a total cost of $2,000,000. The only large ditches are those owned by the Mokelumne Hill and Campo Seco Company and by the Union Water Company.*

The principal quartz mining towns are Angels, West Point and Carson Hill. Murphys, Douglas Flat and Cave City are placer mining towns on the limestone belt. Mokelumne Hill and San Andres are near old channels, and both have some shallow placers. Jenny Lind and Campo Seco had rich placers in early days, but both are exhausted now, at least so far as the present wages and modes of working will permit. Cat Camp, near the western line of the county, not worked hitherto because of the lack of water, is to have a ditch finished before the end of the year, and 350 claims have been located there in anticipation.

Deep beds of gravel have been found in several high ridges in the eastern part of the county, but so far as they have been examined they have not proved rich enough to pay for hydraulic washing. It is known that there are considerable deposits of gravel near the Big Tree grove. Some explorations have been undertaken in the hope of finding in that neighborhood the Big Blue lead of Sierra and Placer counties, but without success.

El Dorado Flat is a portion of an old channel near the Stanislaus river, 300 feet above its level, and half a mile above Robinson's ferry. The gravel is 100 feet deep, and the bed rock pitches as if the stream had run up the course of the present Coyote creek. Ten men, in four months, took out $7,000 at El Dorado in the early part of 1867.

The Mokelumne river paid very well at nearly all the bars, more than a dozen in number between Union bar and Clay's bar, and even in the bottom of the channel. At Sandy bar 107 pounds of gold were taken in two days by seven Frenchmen. The river was flumed every year from 1850 to 1865, and for the first seven or eight years paid high. At Union bar much of the gold was in pieces resembling melon seeds in size and shape. The Mokelumne river has been worked for about 30 miles along its course.

The Stanislaus river has been worked every year since 1849. In that year the work was confined chiefly to the bars; in 1850, 1851 and 1852 the stream was dammed at many places and turned, but paid at only a few. The bed, except near the mouths of Carson's creek, Coyote creek, and Jackass gulch, was comparatively poor. The best diggings were found at the heads of bars and near high-water line, and the rich spots in the deeper parts of the bed were nearly all in crevices, some of them made by the decomposition of quartz veins. After 1853 the river was flumed repeatedly, but in nine cases out of ten these fluming enterprises were unprofitable. The river mining, for the last six or seven years, has been mostly in the hands of Chinamen.

BIG TREE GROVE.—The Big Tree grove, situated 15 miles from Murphys, 81 miles from Stockton, and 4,500 feet above the level of the sea, is a favorite place of resort. Five days' time and $50 are required to make the trip from San Francisco and back in the cheapest and most expeditious manner. The elevation is so great that snow lies four or five months in the year, and the hotel, which is commodious and well-kept, does not open for visitors until May or June, according to the season. The grove contains 90 trees over 15 feet in diameter, and of these ten are 30 feet through just at the ground, though 10 or 15 feet above the diameter is considerably less. Five men spent 22 days in 1854, cutting down a tree which was 92 feet in circumference and 300 feet high. The stump has been taken as the foundation and floor of a house in which dancing parties are sometimes held. There is abundant room in it for a large quadrille. The bark was taken from another tree to a height of 116 feet from the ground—up to where the branches began—at the same time, and the tree did not begin to show signs of dying until two years afterwards, and some of its boughs were green six years later. It is estimated that one of the trees which had fallen long before the grove was discovered was 450 feet long and 40 feet in diameter. Prof. Whitney carefully counted the rings of the tree which was cut down and found that they numbered about 1,300. The big trees are scattered about in a forest of very large trees, many of which are as high, and some almost as large, as the smaller specimens of the *sequoia gigantea*, as the big tree is technically named. The number of visitors annually is about 2,000.

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* Mr. Watson, referring to the resources of Calaveras county, says: "The sectional area of this county is 1,140 square miles, with but 98 square miles or 62,763 acres of cultivated land. The assessor's valuation of the county is $2,004,430. The population, 16,299 in 1860,* is mostly engaged in mining pursuits, and are large buyers of imported products and merchandise, all of which must pass over the Stockton and Copperopolis railroad. Aside from the gold and copper of this county, there are extensive quarries of marble and granite of very superior quality, which cannot be worked at the present rates of transportation. Her upper range of mountains are covered by a dense forest of pine and oak, embracing an area of about 300 square miles, which can probably be transported to the San Francisco market for 25 per cent. less than an equal quality of timber can be procured from any other source on this coast. In this county is located the Big Trees or "Mammoth Grove," which, as a curiosity, attracts thousands of tourists every year, and, as a natural production, it excites the wonder and admiration of every visitor. The up freights for the county will amount to 15,640 tons per annum, and down freights, including copper ores, 65,400 tons per annum—total, 71,040 tons.

* Estimated population in 1866, 12,000.—*Swett's Report on Public Schools.*

AGRICULTURE.—Agriculture in Calaveras county is not in a very flourishing condition. Water is not cheap enough to be used for irrigating grain or pasture land; fruit and wine will not pay the expense of transportation to Sacramento, and brandy will not pay with the present tax upon its production. There are a multitude of fine orchards and vineyards, but as many of them are unprofitable, so they are neglected. With cheap water and cheap transportation to market this county should be prominent in the production of wool, wine, and fruit.

At Douglas Flat, in the orchard of Mr. Hitchcock, the peach thrives better than any other tree fruit. The yield is very large and regular, and the quality good. Apricots do not thrive. The white winter Pearmain apple bears well and keeps well. The Porter apple bears well, and though rated as a fall fruit in the eastern States, keeps here till February. The Wine Sop keeps till June. The Newtown pippin is the best keeper, bears well, and has a fine flavor. The Belleflower, Northern Spy, and Peck's Pleasant are good at neither bearing nor keeping. The Vandevere bears tolerably, but does not keep. The Esopus Spitzenberg keeps well, but does not bear heavily. The Roxbury Russet bears very well, but does not keep. The same may be said of the Baldwin, except that it bears well only in alternate years. The Golden Russet is one of the best and most regular bearers and keeps till December.

At Murphys, although the distance is only two miles from Douglas flat, the fruit is two weeks later in ripening, and the more delicate kinds, such as figs will not ripen. The difference in elevation does not seem to be more than a couple of hundred feet. In the western part of the county figs are very productive.

METEOROLOGY.—The amount of rain in the rainy season of 1865 and 1866, at Murphys was 31 inches, and in 1866 and 1867 44 inches.

As much as 10 feet of snow has fallen at the Big Trees in one storm, but the depth is seldom more than five feet at any one time. As the ground does not freeze, there is no good sleighing.

SAN ANDREAS.—San Andreas is the present county seat, and is situated at a point where San Andreas ravine intersects an ancient river channel. The county seat was formerly at Mokelumne Hill, on the northern limit of the county, and was removed after the people had voted at a special election for San Andreas. Great frauds were practiced in the election, especially at Mokelumne Hill, which then contested the election, and years elapsed before the courts and county offices were removed to San Andreas, which had spent $75,000 in the contest. The people of the new county town were much chagrined to find that there was scarcely any perceptible increase in the amount of business or in the value of property after the change, and many of those who spent their cash would be glad to have it back, even if Mokelumne Hill were to have its former dignity. The monthly shipment of dust from San Andreas is $25,000, nearly all placer.

THE SAN ANDREAS OLD CHANNEL.—An ancient channel runs past San Andreas, and indeed it is to the rich deposits of the old river that the town owes its existence. This ancient channel has been traced a distance of eight miles from the head of Old Gulch, past San Andreas, and Gold Hill, to the south fork of the Calaveras. The general course is nearly west; the average width is 100 feet, and the depth under the surface is 150 feet, of which about 100 feet is volcanic sand. The richest pay stratum is a soft blue gravel, four feet deep, which yields seven-eighths of its gold at the first washing; but there is also a red cement, which sometimes usurps the place of the blue gravel on the bed rock; sometimes overlies it, and sometimes occupies half the channel, leaving the blue on the other side. This red cement is not so rich as the blue, nor is the gold so coarse, and it should be crushed in a mill, if more than one-third of its gold is to be got at the first washing. Some of the gold found in the blue gravel is quite black.

It has been reported that a petrified turtle thirty inches long was found in one of the claims on this channel; but the report is mentioned here not to accredit it, but suggest it as a matter for investigation.

Mr. Marshall says he found in the pay dirt in the claim of Marshall and Showalter an Indian mortar, and this is perhaps one of the best authenticated cases of human handiwork found in an ancient stream.

In that claim, starting from the surface, the shaft passed through 5 feet of coarse gravel; then sand and gravel 100 feet; then a thin bed of fine brownish gravel; then 4 feet of cemented sand; then 15 feet of blueish volcanic sand; then 6 feet of pay dirt, and finally slate-bed rock, one foot of which is rich.

The following is the form of a notice used in locating a claim on this channel:

NOTICE.—The undersigned claims this ground for mining purposes, known as the Robert McCall & Co.'s claim, being a deep or shaft claim, and being bounded on the northwest by the Gilchrist and Cornwell claim, and on the southeast by the Plug Ugly claim, 1,000 feet more or less, and he intends to work it according to the laws of the San Andreas mining district.

WILLIAM IRVINE.

JOHN SHOWALTER, *Recorder*.
August 18, 1862.

The first notable claim on the channel commencing at the highest point that has been worked is that of Foster, Frazier & Co., 800 feet long on the channel, where the depth is 100 feet. It has been worked 10 years, and paid about $7 per day to the hand. The pay is obtained by drifting, and is taken to the surface through a shaft and tunnel.

After an interval in which the channel has not been found, we come to the claim of McLaughlin and Dore, who have been at work 10 years, and have averaged about $5 per day. Three or four men are now employed on the claim.

After another space in which the channel was not found, is the claim of George Barnhardt & Co., situated on the hill between Old Gulch and French Gulch. It has been worked six or seven years, and four or five men are now employed in it. It is a hydraulic claim, and the bank is 75 feet deep.

The next claim, that of Young & Co., is on the hill, south of upper Caleveritas, and has paid well for 10 years. It has been worked both by hydraulic and by tunnel. Three or four men are employed.

Knight, Simpson & Co., work their claim by the hydraulic process, with four men. It has paid well for six or seven years.

The railroad claim on Railroad Hill, one mile below the previous claim, has never paid, but has broken several parties who took hold of it. It is now idle. The channel was never found in it.

Wade, Johnson & Co., between Yaqui Gulch and lower Calaveritas, employ four men in their claim, which they work by drifting, and have obtained moderate pay.

Hedrick, Wilcox & Co., are working with three men, and getting very moderate pay. They erected a cement mill, but the gravel was not rich enough, and the mill was moved to a quartz mine at Fairplay.

The Plug Ugly claim, 800 feet long has yielded $1,100 in one day, and still contains rich ground. Contention among the shareholders has prevented work for two years.

Irvines claim, 1,000 feet long, has been worked for two years, and has paid well. The gravel is so tough that after being slaked for a while it will yield ten times as much in the sluice as it will if washed immediately after coming out of the drift. The proprietor is now erecting a water-mill to hoist and crush the cement.

The claim of Patrick Gilchrist, 180 feet long, paid well for a short time, but is closed now as if worked out, though some good miners think it still valuable.

Marshall and Showalter have 600 feet, and have been at work for 13 years, usually employing six or eight men. Their claim has been very rich, and it yielded nine pounds in one forenoon. The dirt is hoisted by a whim.

The Marlette claim, 600 feet long, was opened about 1857, and work was stopped in 1861, for want of drainage.

The McFall claim, 600 feet long, has been worked for 10 years, and has paid about $10 per day to three men. The proprietor of this claim cut a long drain at considerable expense and solicited some contribution from the claim owners above, but they refused, so he left 20 feet at the head of his claim standing, and this served as a wall to back the water on the Marlette, Marshall, Plug, and Irvine claims, and stopped work in parts of them for five years. Lately they have paid $1,000. The drain has been opened and they have resumed work.

The Dunning claim, 400 feet long, was opened in 1854, and was worked out in five years, during which time it paid about $20 per day to six men. One pan yielded 12 pounds, and in one week $10,000 was taken out.

Here the channel strikes San Andreas gulch, and below this point the old channel is six feet or more below the level of the present stream, in some places 35 feet deeper. For 1,500 feet the channel is under the gulch, and there, because of the shallowness of the ground, the diggings were very profitable when first worked. After leaving the bed of the gulch the old channel runs 1,000 yards to Gold Hill, where a remarkable fault is found, the channel having been here broken off and raised up 100 feet perpendicularly by some convulsion of nature. The bed rock, the size, course, and grade of the channel, and the character of the gold and of the strata, all indicate that the Gold Hill diggings belong to the ancient river of San Andreas. The Gold Hill claims paid well, but are now all worked out.

MOKELUMNE HILL.—Mokelumne Hill was for a long time the largest town in the southern mines, and it is now one of the most populous. It is situated on the south bank of the Mokelumne river, but about 800 feet above its level, at a point where an ancient channel has been cut through, leaving a convenient pass for travel from north to south and exposing rich deposits of gold near the surface. The town, instead of being on the summit of a hill, as might be inferred from its name, is rather in a flat or basin, with hills several hundred feet higher both east and west. There are a number of very pretty gardens in the suburbs. Many of the business houses are built of a light lava or tufa, which is found abundantly in the neighborhood. Houses in the town are sold for about one-fifth their cost. Mokelumne Hill is a stage centre from which lines run to Stockton, (45 miles,) to Sonora, (50 miles,) through San Andreas, Angels, Vallecito, and Columbia, to Latrobe, (38 miles,) through Jackson, Sutter, and Dry Town, and to West Point, (16 miles.) There is also a horse mail to Campo Seco, 12 miles distant.

In the spring of 1851 three Frenchmen found an extremely rich old channel high up on the side of French Hill, northeast of the town of Mokelumne Hill, and in a few days took out $180,000. They attempted to keep their wealth a secret, but in vain, and some Americans found it out and went into the claim at night and stole from it. One night they dug out a piece weighing 11 pounds, but as it was dirty they did not discover its character in the dark, and threw it aside. The Frenchmen found this piece the next morning, and a piece of candle which had been left behind; so the next night they watched their claim in arms. The robbers, finding themselves foiled, laid claim to the mine, and threatened to take it by force, and the Frenchmen of the neighborhood assembled to defend their countrymen, since, if the claim of one Frenchman could be taken, there would be no security for the others. There was much animosity at the time against foreigners, and the report that the Frenchmen were arming gave great offence, and soon there were two armies ready for the fight. The French vice-consul at Mokelumne Hill acted as mediator, and succeeded in making a compromise, by the terms of which a committee of American miners were placed in possession of the claim to work it until they had taken out enough to pay the expense of the military organization of the Americans, and then to return it to the French owners. The committee worked at the claim for months and worked it out, and the entire sum that they paid from it towards the expenses of the military organization was $1,100, a sum less than the Frenchmen had been in the habit of getting nearly every day. Thus ended the French war, in which many French cabins were burned but nobody was killed; though attempts were made to assassinate several Frenchmen, and one American who, having been appointed to consult with the French consul, took sides with the Frenchmen. Before the compromise was effected the Frenchmen fortified themselves on Corral Hill, but they fled when they saw the enemy coming to storm their works. This discretion saved much bloodshed, for the assailants outnumbered the entrenched party, and they had laid their plans so that the French would be exposed at the time of assault to the fire of an enemy occupying a commanding position in the rear.

MOKELUMNE HILL OLD CHANNEL.—The Mokelumne Hill old channel begins or is found at its highest point about a mile east of the town of that name, near the residence of J. Tynan, and runs thence under Corral Flat, striking Stockton Hill, (at a point between the Stockton Hill upper diggings and the Water Company's claim,) thence passing in a southwardly direction under the Stockton Hill ridge, about 330 feet below the surface, until it strikes Chile gulch, under the Innes & Co. claim, which gulch it then follows down on one side or the other to its intersection with the old San Andreas channel, where the two unite. This channel has been worked to great profit in some of its parts, and others, though opened very thoroughly at great expense, have proved entirely barren. The largest yield has been obtained east of the point where the old channel first strikes Chile gulch, but further down there is a place called Junction, where a number of claims have proved very rich.

The Water Company's claim, 1,800 feet long, in Stockton Hill, southwest of Mokelumne Hill, has been worked by several long tunnels, and has yielded, according to rumor, $110,000.

The Water Company's cement mill, on Chile gulch, near Mokelumne Hill, has 10 stamps, and is driven by 40 inches of water forced under 100 feet head upon a hurdygurdy wheel.

The Paul claim, 2,600 feet long, has been worked continuously for ten years, and has paid well, the net yield, as stated by common report, being $160,000.

The Calaveras Tunnel Company worked from 1857 till 1866, and did remarkably well at first, but afterwards spent much money in hunting for the channel, and made but little gain as the total result of their labors.

The Allen claim, 1,000 feet long, was worked from 1859 to 1865, and was not profitable.

The Innes claim, 1,100 feet long, was worked from 1856 to 1864 by a tunnel 1,400 feet long, which passed over the deep channel, and by four shafts from 45 to 110 feet deep. The result was the loss of nearly all the money invested.

The Cubberly claim has yielded some very rich pay gravel.

The Amherst claim, 1,400 feet long, has proved extremely rich. The channel here crosses a streak of soft rock called "rotten granite" by the miners, and this has caught the gold which has slidden over the harder rock. The claim has been worked for 10 years, paying all the time. For 5 years, 10 or 12 men were employed; now there are 4. It is reported that a partner who had owned half the claim went to the east in 1862 with $28,000. The work was done by drifting for some years, but the tunnels have caved in and now the hydraulic process is used.

The Shaw claim has been worked 10 years, most of the time with large profit. An attempt was made lately to pipe away the dirt through a shaft and tunnel, but the shaft caved in, and it is now necessary to pipe away the dirt from the outside of the hill.

This completes the list of the claims in Stockton Hill, commencing at Mokelumne Hill and running down stream. Mention has been made of but one old channel running under this hill, but really there are two, the smaller one being from 90 to 120 feet above the level of the main old channel. About a mile and a quarter below Mokelumne Hill the upper channel breaks off and seems to fall 90 feet into the lower channel, and it does not appear again below that point.

OPALS.—In the north end of Stockton Hill, almost within the limits of the town of Mokelumne Hill, is an opal-bearing stratum about 60 feet below the surface of the hill. This stratum is a rough gravel enclosed in a tough reddish clay, from six to eighteen inches deep, lying between two layers of volcanic sand. In 1865 three claims were worked for opals, which were obtained in great abundance, but they were of very common quality and did not pay. None of the fire opals were found. The dirt, when taken out, was allowed to dry, and was then broken up with wooden mallets, and the opals, which were from a quarter of an inch to two inches in diameter and white in color on the outside, were picked out by hand. The longest opal tunnel ran 190 feet into the hill.

On one occasion there was much excitement at Mokelumne Hill on account of the rumored discovery of a mine of emeralds and sapphires, and men went out at night with lanterns and staked off a large district in claims. Afterwards they investigated the nature of the first discovery, and came to the conclusion that the supposed precious stones were only pieces of colored glass which had been in the gizzard of a turkey.

CAMPS NEAR MOKELUMNE HILL.—Tunnel Ridge, one mile southeast of Mokelumne Hill, is three miles long, has a cap of volcanic rock, beneath which in places is found a stratum or lead of auriferous gravel, most of which has been worked through tunnels.

Buckeye, two miles east of Mokelumne Hill, has several hydraulic claims, which have been worked for six years. One of them is now paying well.

Buena Vista Hill, four miles northeast of Mokelumne Hill, has four hydraulic claims, which have been worked for ten years with much profit. The ground is very rich, but the water cannot be taken to the top of the hill, and therefore the expenses are great.

Rich Gulch, six miles east of Mokelumne Hill, had very rich surface claims in early days, and still yields well in a few spots.

DOUGLAS FLAT.—Douglas Flat is situated on the limestone belt, which is here a mile wide. The deepest workings are at a depth of 150 feet; and in those places the pay began 125 feet from the surface, and was covered with three strata of volcanic ash, with intervening strata of coarse gravel. The deep claims were worked through shafts, with pumps and hoisting apparatus driven by ditch water. The town has been more permanent than most mining camps because of the deep diggings, and according to repute it has produced more gold in proportion to its population than any other in the county.

Among the notable claims are the following:

The Texas, 500 feet long by 150 feet wide. The pay stratum is from 6 to 25 feet deep and 125 feet below the surface. Work was commenced in 1853, and has continued since with an interruption from 1859 to 1862, caused by water. The claim employs 8 or 10 men, and it pays, sometimes, $500, and never less than $200, per week above expenses. The total production has been about $60,000, and there is pay ground enough to last for 5 or 10 years more. A stream of water yielding 16 inches, miners' measure, has been struck in the bottom, and a pump with a pipe 14 inches in diameter, with a five-foot stroke, is used for keeping the claim clear. The lowest drain is 60 feet below the surface. A tunnel to drain the bottom of the claim would have to be two miles long.

The Union claim, 1,000 feet long by 100 wide, was opened in 1860, and is 150 feet deep. The average number of men employed was ten, and the average weekly yield has been about the same as in the preceding claim. On one occasion they took out 90 ounces or $1,700 per week for several weeks. The total yield has been about $40,000. The claim is doing nothing now, but work will be resumed.

The Wild Goose claim, 800 feet long by 100 wide, has been worked to a depth of 200 feet without finding bottom or pay. A drift is now being run in hope of finding bottom. Four years' work and $15,000 have been spent without any return so far. In two drifts of this company the dirt swelled so fast for three days that the drifters made no headway.

The Perseverance claim, 800 by 100 feet, has been worked to a depth of 130 feet without finding anything, and the shaft is still going down. A drift run into this claim from the adjoining Union claim has struck rich pay gravel.

The Dashaway, 1,000 by 100 feet, has been worked by an incline 300 feet deep perpendicularly from the surface, which is there on a hillside. The claim has been worked five years, and has produced about $25,000. Five men are at work in it.

The above are the only companies now working or likely to work soon.

The Southwestern claim, 1,200 by 100 feet, yielded $750,000, and is worked out.

The Ohio, 800 by 100, yielded $50,000; worked out.

The Harper, 200 by 100 feet, yielded $100,000; worked out.

The Lone Star, 300 by 100 feet, yielded $100,000; worked out.

The Holmes and Toll, 100 feet square, yielded $100,000; worked out.

The Hitchcock and Burgess, 100 by 50 feet, yielded $100,000; worked out.

The Skunk Tunnel, 400 by 100 feet, yielded $50,000; worked out.

MURPHY'S.—Murphy's, 16 miles from San Andreas, formerly known as Murphy's Camp, is situated on the limestone belt in a pleasant valley surrounded by low hills. The diggings are found here in a basin half a mile in diameter, with dirt and gravel to a depth of 200 feet. The pay stratum was found in some places within twenty and in others within 100 feet of the surface; but little of it was high enough to be washed in the natural channels, so the miners hoisted the dirt by derricks, or with a horse, rope, and pulley, to their sluices. Afterwards, however, an open cut 900 feet long and for a considerable distance 40 feet deep was made. This facilitated the washing of the flat greatly. There were a dozen claims which paid high, averaging $100,000 or more each it is said, but there is no record of the details. The Rhodes claim, one of the richest, produced $250,000 from an area 100 feet long and 40 wide. The deepest workings were 100 feet. In one afternoon it paid 37 pounds, and the next forenoon 63 pounds of gold. In this claim a tunnel was cut through a large mass of limestone far below the surface, and in the midst of the mass was found a cavity containing a rich auriferous quartz boulder weighing not less than half a ton; and there was no orifice leading to the cavity large enough to let in a stone weighing 20 pounds. There was, besides, some rich gravel in the cavity. This statement about the quartz boulder, if it came from some unknown source, would deserve no consideration, but it is vouched for by Alonzo Rhodes, agent for Wells, Fargo & Co., who is an intelligent gentleman, and is reputed to be most trustworthy.

Murphy's derives some importance from the fact that it is a stopping point for travellers going to and from the Big Trees.

Some of the gold at Murphy's was quite black on the surface.

Between Murphy's and Douglas Flat an old channel has been traced for 600 feet.

VALLECITO.—Vallecito, 14 miles from San Andreas, is a level valley, with deep diggings, which are covered with three strata of lava or volcanic sand. The valley was in its most flourishing condition from 1852 to 1855, and is still far from being worked out, but there was a lack of drainage, and the claims which would pay for drifting have been exhausted. In 1855 a mammoth tunnel, to be 2,700 feet long and 100 feet deep, was commenced, to drain the flat, which is about 86 feet deep in the deepest workings. After 400 feet of the mammoth tunnel had been cut, a considerable part of the way in very hard greenstone, and after $15,000 had been spent, the work was abandoned. In 1862 a new tunnel, to be 1,500 feet long and 36 feet below the surface, was commenced, and last spring it was completed, though the flume is not yet ready for washing. The flume in and out of the tunnel is to be 2,000 feet long, and the total cost of the work is $30,000, exclusive of interest. An ancient channel 100 feet wide has been traced for half a mile up and down the valley, and it is considered still rich. The ground is held by old miners, who will now wash off their claims through the tunnel. No public notice has yet been given of the conditions on which miners can tail into the tunnel.

The shipment of gold from Vallecito is $20,000 per month; formerly it was $60,000.

The Day and Hunter claim in Vallecito Flat was 100 feet square, and paid $25,000.

The Isabel and Mitchell, of the same size, paid the same amount.

In the Durham & Co. claim a piece weighing 25 pounds was found.

There were 50 claims in the flat that paid well, but there is no record of their production severally.

Near Vallecito is a gravel ridge 60 feet deep, and a portion of it paid well in hydraulic claims.

MINOR PLACER CAMPS.—At San Domingo, on the limestone belt, four men took out $100,000 in three years, commencing in 1863.

Near Murphy's is Owlburrow Flat, which is rich and might be drained.

Indian creek, San Antone, and Cave City, on the limestone belt, have had some rich claims, but the diggings are now nearly exhausted.

QUARTZ REGULATIONS OF ANGELS.—The quartz reglations of the Angels district provide that a lode claim for one person shall be 100 feet on the vein, with 150 feet on each side; and a discoverer is entitled to 50 feet more on the vein than an ordinary claimant. The regulations say:

> He or she [the claimant] shall have the right to all the dips, strikes, or angles of every vein originating on the claim. We understand that a vein originates on or below the surface running downwards, and not from below running upwards; so that no person or persons locating a claim on either side of the boundaries of another shall have a right to a vein running through his or their claim that originates, as above understood, on the claim first located; but no man shall have the right to follow a vein on the length of it beyond the perpendicular of his boundary.
>
> Miners shall be compelled to perform at least 10 *bona fide* days' work on their claim or claims during the year commencing from the first day of April, 1860. Miners failing to do so, their claim or claims will be considered forfeited and open to other parties.

It will be observed that there is no express requirement of any work after the 1st of April, 1861, as a condition of title; but the intention was undoubtedly to require 10 days' work on each claim within each year, ending with March.

The records of this district were burned in 1855, and no copies or written evidences of title before the fire are preserved.

There are 57 quartz claims on record in the district, and 55 of them bear date previous to 1864. In that year no claim was made; in 1865, one; one in 1866; and none in 1867 up to June 1.

QUARTZ REGULATIONS OF SAN ANDREAS.—The following are extracts from the miners' regulations of the San Andreas district for ledge mining:

> Claims in said district shall be 200 feet in length on the lead, with all its dips, spurs, and angles, with 300 feet in width on the surface.
>
> Shareholders shall be compelled to perform one day's labor for each 200 feet held or claimed by them, or its value in improvements thereon, in each month, from the first day of May to the first day of November in each year; if they fail so to do their claim shall be considered forfeited and open to entry by other parties, unless the first parties shall have been prevented by sickness of themselves or families from complying with this law. When a company shall have put $500 worth of work on a claim the same may be held over for one year, and no longer, by a renewal of the record of said claim, made at any date previous to the first day of May of each year, during which year the parties owning such claim shall not be compelled to perform any work on the same.

These regulations were adopted in March, 1866; and there are 57 lode claims recorded, the latest dated in 1865. There is no quartz mine in operation in the district, save at Wilson's creek, where there are two arrastras at work.

QUARTZ MINING IN CALAVERAS.—The most noted quartz mines of Calaveras county are the Morgan, the Reserve, the Enterprise, the South Carolina, the Stanislaus, the Union, and the Carson Creek, at Carson Hill; the Bovee, the Angels, the Hill, and the Sickles, at Angels; all on the mother lode; and the Woodhouse, near West Point. A number of rich veins have been found near the limestone belt, but their wealth has been confined to pockets.

MORGAN.—The Morgan mine, 500 feet long, on the mother lode, was discovered in 1850 by a man named Hance, who took in six partners, Morgan being the president. The discovery was made on the summit of Carson Hill, and the rock was extremely rich; indeed, if the statements of those who lived at the place are to be taken, the gold was abundant beyond any parallel. Much of it was taken out in mortars, and not unfrequently there were so many strings of gold in the rock that cold chisels had to be used to cut them. On one occasion gold to the amount of $110,000 was thrown down at one blast. The news filled the State with excitement. The town of Melones, on the southern side of the hill, became the largest mining camp in the State, with a population variously estimated from 3,000 to 5,000. People came in crowds to see the mine. Robinson's ferry, on the Stanislaus river, two miles south of the place, took in $10,000 for ferriage in six weeks. From February, 1850, till December, 1851, the production continued uninterrupted and with very little decline. In that time, according to Thomas Deare, who has lived at the mine longer than any other person, $2,800,000 were extracted and immense sums were stolen. It is reported of one Mexican miner that he stole $1,500 in one day from the arrastra which he had in charge, and paid it the next day for a horse. All the rock too poor for the hand mortar was ground in arrastras, and it is said that 50 of them were running at one time. The facilities for stealing were great and the temptation strong. Gambling was carried to a great extent and gold seemed to have lost its value. The miners were mostly Mexicans, who, as a class, were not looked upon with much favor by American miners; but they had had some experience in this kind of mining and their services were indispensable. They could pick up the lumps of gold in the mine, or they could take handfulls of amalgam from the arrastra with little fear of detection. As for the amount taken in this way, it could never be ascertained, but that it was great was assumed in the common conversation of the miners themselves.

The vast production was too great to be witnessed in peace. Several hundred ruffians banded themselves together under the lead of Billy Mulligan and others of his kind and drove away the owners of the mine by force and worked it themselves. A suit to eject them was commenced, and after nine months their work was stopped by injunction, and in the spring of 1853 final judgment was rendered in favor of Morgan and his associates. Morgan then went to England to sell the mine, but more litigation sprang up about the title, and there was no final decision and very little work till the spring of 1867, the mine having lain idle for nearly 15 years. The work has lately been recommenced, and report says some marvellously rich rock has been taken out, but the superintendent did not consider himself authorized to give the precise facts for publication.

The mine is near the summit of the hill and includes two veins, which unite 100 feet below the surface. One is about six feet wide and called the stratified vein, because of numerous seams parallel with the walls; the other is 40 feet wide and is called the boulder vein, because the quartz in it is solid and boulder-like. A tunnel 160 feet long strikes the vein 100 feet below the outcroppings, and from this drifts have been run 200 feet on the vein, finding pay rock all the way. The richest rock is a talcose slate on the foot-wall. The mine can be worked conveniently by tunnels to a depth of 500 or 600 feet. There is no mill now, but the proprietors propose to erect one, and they are now taking out rock. In the middle of June they had 5,000 tons already out.

Reserve.—Immediately south of the Morgan is the reserve mine, 980 feet long. This mine was opened in 1860 by a tunnel 300 feet long and a shaft 135 feet deep, and common report says that 3,000 tons of talcose slate were crushed and $200,000 obtained. A report made by a French mining engineer to the Melones and Stanislaus Mining Company, which is better authority than common report, says the yield has been $130,000. Mr. Coignet, the author of the report, says:

> The lead worked at the Reserve belongs to that order of vein which runs west 15° north, east 15° south, and is rich in ore throughout its whole extent. At the walling, [foot-wall,] and for many feet in width, the slate formations are impregnated with auriferous pyrites, partly decomposed near the surface. * * * I was told on the spot that the slate formations of the casings throughout the length of the claim did not pay less than $18 per ton at the mill, and that the ore formerly extracted contained from $90 to $300 per ton.

Enterprise.—The Enterprise, 900 feet, adjoining the Reserve on the south, has been opened by a tunnel which runs 450 feet on the lode. There is no mill connected with the mine, nor is any work being done.

South Carolina.—The South Carolina, 2,550 feet long, adjoins the Enterprise. The vein is seven feet wide, and has been opened by drifts running 580 feet on the lode, 280 feet below the surface, in pay chimney all the way. The mine was first worked, from 1850 to 1853, by some Mexicans under a lease, who accounted at the rate of $85 per ton; but rumor says that the actual yield was much larger, and that the total amount which they took out was $400,000, and that they got $40,000 in one week from their arrastras. In one period of seven months they accounted for $119,000, and paid over, according to contract, one-half, or $59,500; but the owners were dissatisfied, and terminated the lease in 1853, and the mine, notwithstanding the general belief in its great wealth, stood still five years. In the spring and summer of 1858 a ten-stamp mill ran for three months and took $19,000, and then the work was stopped by litigation. The last rock taken out paid $40 per ton. The mill is now in ruins, and no work is being done. Mr. Coignet says of the South Carolina:

> The quartz is generally white-bladed, foliated with green, slaty streaks, and assuming a striped appearance. It is in these slate formations that the flattened or laminated leaves of gold are found. Sometimes the quartz is compact and yellowish, but then it is nearly always near an intersection. Against the walling [foot-wall] of these leads the slates are of a yellow brown, very talcose, and perforated by cubical holes, indicative of deposits of rotten iron

> pyrites. These are ductible, and can be cut with a knife. Between their strata is found some bluish quartz surrounded by pure gold. On the whole line of the leads, beginning at the South Carolina claim and up to the Hope, where they still exhibit the same character, it may be said that these slaty formations, in a breadth of several feet from the walling of the lead, contain at least $18 per ton.

STANISLAUS.—The Stanislaus mine, 1,200 feet long, is on the middle branch of the mother lode, immediately north of the Stanislaus river. At this claim the vein runs nearly north and south, and dips to the east at an angle of 75 degrees. The mine has been opened by three tunnels, one 400 feet long and two of 100 feet each, and by several shafts running down from the tunnels. The quartz is remarkable for containing much gold in the form of a telluride, which, though very rich, has never been worked so as to yield much. Mr. Coignet, who examined the mine, says:

> The quartz croppings are white, with reddish tints in the cracks, and containing crystals of feldspar, of carbonate of lime, and of iron. The free gold which had been found on the surface changed readily into tellurets of gold and silver, and into auriferous iron pyrites, which, by their decomposition when in contact with the atmosphere, have spread a reddish hue over the rock. In these ledges, among which the Stanislaus offers an example, the thickness of the quartz varies considerably, both in its course and incline, whereas the roofing [hanging wall] remains perfectly regular. Thus, from the middle of the tunnel to within a few feet of the shaft, at the northern extremity of French and Wood's claim, the croppings have a thickness of more than six feet, whilst beyond that space the quartz disappears in the slate, without, however, causing a break in the lead. At the bottom of the shaft just mentioned the lead has a depth of six inches and contains numerous crystals of tellurets. At 120 feet south of the entrance to the middle tunnel a shaft was formerly sunk by Mexicans, by means of which a large sum was taken. There also the quartz has disappeared, and the ore is found in the slate.
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> The rich deposits of the lead are found in chimneys with a horizontal incline of about 31 degrees to the south in the walling, [foot-wall,] and in the small quartz feeders which follow the line of the slate formations, and at their junction with the principal leads. It is of importance to observe, with regard to this mineral system, that tellurets are found exclusively in the quartz which contains crystals of feldspar and carbonates of lime and of iron; and hence, whenever these minerals are met with, the speedy appearance of ore may be relied upon.
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> The compact quartz of the lead is often found to contain, and, in fact, generally does contain, auriferous iron pyrites, which are sometimes of great richness. The slate formations in which the lead is imbedded are also full of iron pyrites, but contain no gold, or perhaps a very small amount. The difference between these two kinds of pyrites is such that they can be readily distinguished from each other. The richest pyrites, in fact, seldom crystalize very distinctly, being in compact masses, which clearly exhibit the numerous lines of cleavage; they are very bright, and have a very distinct yellowish appearance. The indifferent pyrites, on the contrary, are found in well-defined cubical crystalizations, isolated, and with a sharp edge, and usually disseminated through the slate formations.
>
> Throughout the length of the zone [the main pay chimney] the roofing [the hanging wall] is well defined, but the walling [the foot wall] is irregular, and composed of quartz feeders which follow the stratification of the slate formations and finally unite with small quartz veins containing feldspar, carbonates of lime, and, as is the case always, some tellurets. The association of these minerals is so perfectly verified that when one is met there is a certainty of the presence of the others at a short distance. * * * *
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> These ores are sometimes of an extraordinary value; thus, during my visit to Melones, an assay which I made myself on four ounces of sulphurets and tellurets, taken from a concentration of second-class ores, yielded $150 of gold and $1 of silver, or about $17,500 to the ton of concentrated sulphurets. * * * No process of economical manipulation of this class of ores has, as yet, been found without inflicting serious losses. The concentration which has to be resorted to, costly in itself, still permits the escape of a large portion of the precious metals.

Charles A. Stetefeldt, a mining engineer and metallurgist, to whom specimens of the ore from the Stanislaus mine were submitted, wrote a report, in which he said:

> These ores are of extraordinary interest for the mineralogist and metallurgist, since besides their great richness in native gold, they contain also telluric gold and silver in such quantities as have never before been known. Telluric ores of all kinds are extremely rare, and found only in small quantities at the following places: at Offenbanya, Salathna, and Nagyag, in Transylvania; at Schemnitz, in Hungary; at the Sawodinsky mines, in the Altai mountains; and at Spottsylvania, in Virginia. But at none of these places are the telluric

ores as important as in the Stanislaus mine: on the contrary, the quantity found in them is so small that no regular process for their reduction can be said to be in practice. * *

The samples of ore from the Stanislaus mine, shown to me by you, contain large quantities of sylvanite or graphic tellurium, of steel-gray color and metallic lustre, by far the richest tellurium ore, and smaller quantities of the tellurium of lead, recognizable by its tin-white color and great lustre. It is probable that other combinations of tellurium will also be found on a closer examination of the ores. * * * * * *

Science indicates and your own experience fully proves that the ores are not suitable for amalgamation. Quicksilver not only fails to absorb any portion of the gold contained in the telluric combinations, but the presence of the latter prevents the quicksilver from producing its natural effect even upon the native gold, so that even of the latter a comparatively small percentage only can be obtained by amalgamation. Nor would the matter be much helped by separating the tellurium, were that practicable, by roasting, for the Stanislaus ores contain a considerable amount of telluride of lead, and the lead, as is well known, is most injurious to amalgamation. * * * The distribution of the ores in the vein renders a separation of them by hand into three or more different qualities, according to richness, comparatively easy and inexpensive. These different qualities I would submit separately to a process of wet concentration, which for the richer ores would have to be carried on with extreme care. * * * * * * * *

For the first qualities, which contain only a small amount of gangue, I should recommend cupellation with lead. This process consists in melting a quantity of lead in a cupelling furnace and gradually adding the finely-crushed ore as soon as the lead begins to oxydize, and a coating of litharge is thereby formed on the surface. The ore floats about on the molten lead, and the base metals become oxydized through contact with the atmospheric air and with the litharge or oxyd of lead, which has a tendency to give up its oxygen. The oxydation of the base metals immediately liberates the gold and silver, which combine with the molten lead and are retained by it while the oxydized base metals form with the litharge a thoroughly fluid slag, which can be raked off; as much further ore can then be added as the lead is capable of absorbing.

If experience should show that a part of the tellurium also passes into the molten lead in a metallic state, instead of at once oxydizing and combining with the litharge, it will then be necessary to carry on all the earlier stages of the cupelling process in furnaces especially constructed for that purpose. The lead which has absorbed all the gold and silver out of the ore can be worked in these furnaces as long as necessary to oxydize all the tellurium, which will then gradually form tellurite of lead, and be raked off like the first slag formed in the beginning of the process. The purified lead can then be removed to the cupelling furnace and the cupellation be proceeded with in the ordinary manner.

SANTA CRUZ.—The Santa Cruz mine is 1,500 feet long on the western branch of the mother lode, north of the Stanislaus river. This vein is barren so far as examined, except in the walls, where it is crossed by two smaller veins, which run west 15° north. Some of the rock has yielded $300 per ton. A tunnel 240 feet long has been cut, reaching the vein. No work is being done now.

UNION.—The Union mine, 400 feet, is on Carson Hill, and the vein is supposed to be a branch of the mother lode. The vein is 30 feet wide in places, but the best pay (from $20 to $70 per ton) has been found in a seam of talcose slate from two to four feet thick, on the hanging wall. A 20-stamp steam mill is being built now.

CARSON CREEK.—The Carson Creek quartz mine, situated on a branch of the mother lode, near the mouth of Carson creek, is 1,000 feet long. The vein is 12 feet wide for 600 feet, but then pinches out till it is only an inch or two thick. The thick part of the claim has been prospected to an average depth of 40 feet, and rock has been found nearly all along to pay $7 or $8 per ton, exclusive of a few rich pockets. The wall is in places as smooth as glass. There are parts of the vein where the quartz contains enough argentiferous galena to yield 60 ounces of silver to the ton. There is on the claim a 10-stamp mill, which has heretofore been used for dry crushing, but is now being remodelled for wet crushing. The pulp, after passing from the battery and over copper-plate, is to be settled in tanks, from which the sand will be taken to be ground in Hepburn pans and amalgamated afterwards in arrastras with iron floors and stone drags.

BOVEE.—The Bovee mine, 465 feet long, at Angelo, includes four veins which here represent the mother lode. The main vein seems to be talcose slate near the surface, and is from 20 to 30 feet wide. The first vein to the west of this is two and a half feet wide, and barren, and underlies a heavy bed of talc, three and a half feet wide. The next vein is three feet wide, and contains $8 or $10 rock. Then come two feet of slate, beyond which is a vein 15 feet wide, with hard white barren quartz on the hanging wall. At a depth of 120 feet it is only three feet thick, and carries rich sulphurets in spots. The character at that depth changes from a brittle white to a blueish, spermaceti-like quartz, which promises well. The main vein is a hard, white, barren quartz, with occasional spots of sulphurets. It is supposed from the dip of these veins that they will meet and unite about 400 feet below the surface. At the surface they are about 200 feet apart between the outer lines.

The deepest workings are 130 feet down, and at 60 feet drifts have been run 350 feet on the vein. All the rock pays not less than $6 per ton; but there are two pay chimneys, which appear to be nearly vertical, and which paid $16 near the surface, and yield $26 per ton at a depth of 120 feet. Seams of slate appear on the surface, but are not found below. Talc is found mixed with the quartz, and is rich in sulphurets.

As soon as a blast is let off in the mine there are men who set to work to break and select the rock, throwing aside all the barren stuff, of which there is considerable. This breaking and selection needs to be done without delay, because after the rock has been shovelled about it becomes so dirty that its quality does not show without washing.

This mine was long known by the name of its first owner, Mr. Winters, and according to rumor its gross yield under his management was $500,000. He worked the claim along its whole length by open cut; and in his early workings by picking the rock, he obtained $2,000 or $3,000 per ton in an arrastra. No such vein stone can be found in it now, though it is still considered a rich and very valuable mine.

The Bovee mill has 10 stamps of 500 pounds each, driven at the speed of 75 blows per minute, with eight inches drop. The screen is of wire No. 20. The gold is amalgamated in the mortar with loose quicksilver, and below the screen there is a copper plate, after passing which the pulp goes into a tank where the current is arrested, and through another where the current at the surface is not arrested—that is, there is a steady discharge. For a time Mr. Bovee ran the pulp through three tanks, one below the other, with a constant discharge from each; but the experiment satisfied him that the two last did not pay. The first tank below the mortar catches coarse sand; the second catches fine sand; and the third and fourth fill up with slum that does not pay to work. The sands from the first two tanks are shovelled upon a platform, from which they are taken to charge the Wheeler & Randall pans, four feet in diameter, in which they are ground in charges of 800 pounds each for three hours. Half an hour before the grinding is done the mullers are raised a little, and four pounds of quicksilver are put in. The pulp while in the pan is as thick as it can be worked conveniently. To each charge a large peck of hot coal and wood ashes from under the grate are added, and steam is thrown into the pulp. Wheeler, the inventor of the pan, recommends the introduction of 200 pounds of quicksilver at the commencement of the grinding. Bovee uses only four, introduced near the close of the grinding. In Mr. Bovee's opinion, the grinding is facilitated and hastened by keeping the pulp nearly to the boiling point as long as it is in the pans. Three of Knox's pans are used as settlers for each grinding pan. The runs last for two weeks. If the run lasts four weeks a larger proportion of the quicksilver is lost, and that which is saved is corrupt or dirty.

Besides the stamp and pan mill, there is an arrastra mill with 15 arrastras, driven by 61 inches of water on an overshot wheel 30 feet in diameter and three feet wide. The rock is crushed in the stamp mill as fine as peas for the arrastras, in which it is ground for six hours in charges of 280 pounds each. The yield in the pans is 25 per cent. greater than in the arrastras.

Angels.—The mine of the Angels Quartz Mining Company is 900 feet long, and the working vein has an average width of 15 feet of talcose slate mixed with quartz. The quartz-lode is 150 feet west at the surface, and it is supposed that the two will meet about 300 feet from the surface. There is a good gouge on both sides and clay slate walls to the vein. The mine has been worked for 10 years, and is now yielding $8 per ton, though assays show that the rock contains from $15 to $20. The gold is very fine. The mine has a 30-stamp steam mill, with a Blake crusher to prepare the rock for the stamps, two Wheeler pans for grinding, a Belden settler, and lately an experiment has been tried with one of Hesse's pans. The pulp is discharged from the mortar through a slot screen, the orifices being as wide as those in a No. 40 wire screen. The advantage of the slot screen is that it discharges more freely, as the holes are not plugged up by the sulphurets. The deepest workings are 186 feet deep, and the drifts extend along the vein 350 feet, in pay all the way. Most of the early workings were in open cut, and the rock was richer at the surface than in the lower levels.

Hill.—Dr. Hill's mine, 412 feet long, is also working on the talcose slate vein, which averages 15 feet wide, and contains much silicate of lime, besides quartz, the slate occupying a very subordinate portion here. The proprieter of the mine says that most of the gold is found in threads of sulphate of barytes, and in bunches of silicate of lime. Work was commenced on the mine in 1857 with arrastras, and has been continued since with the exception of three years. The total production is estimated at $250,000, and the amount spent in the mine, $300,000. There is now a 12-stamp mill at work on it. The depth from the dies in the mortar to the discharge is 14 inches, and the stamps when raised to their highest point are two inches deep in the water. For a time no screen was used, but the result of the experiment was not satisfactory. The present screen is of No. 60 wire. Hunter's amalgamator and Hill's pan are used. The latter, named after its inventor, the owner of this mine, is a circular copper dish six feet in diameter, six inches deep. A section through the centre represents a segment of an oval. This bowl revolves horizontally on a central axis, and in the centre is a cup to hold quicksilver. The pan makes 18 revolutions per minute. The whole surface of the pan is covered with amalgam. One of these pans at the mill of the Angels Quartz Mining Company saves $200 per month, it is said. In Hill's mine there are numerous horses of barren slate, and in one place a trachytic dike 15 feet thick crosses the lode running west-northwest and east-southeast. About five per cent. of the pay rock consists of sulphurets. The silicate of lime gives a milky look to the pulp as it comes from the mortar.

Stickles.—The Stickles mine, 400 feet long, near the town of Angels, on the mother lode, which is there 20 feet thick, is quartz and pay all the way through, with numerous seams of slate. The deepest workings are 80 feet below the surface, and drifts have been run 120 feet on the vein, in pay rock all the way. There is a 10-stamp mill in operation on the mine.

Utica.—The Utica, 600 feet long, is owned in San Francisco. There was a nine-stamp mill which did not pay, and has been moved away. The deepest workings are 60 feet from the surface.

Lightner.—The Lightner mine, 400 feet long, owned in San Francisco, was worked in open cut for three or four years to a depth of 70 feet with a 10-stamp mill, but the expenses were a trifle more than the receipts, and so the mill was moved away and the mine left idle. If wages were a little lower this mine would pay, for, according to the general opinion in the neighborhood, there is a large body of rock that will yield at least $4 or $5 per ton, and probably $6 or $8.

Ella.—The Ella mine (known also by the names of the Calaveras, the Terrific, and the Demorest) is seven miles northwest of Angels, on a vein which is eight feet wide and crops out along the surface for 800 or 1,000 feet. The vein-stone is a hard ribbon rock, rich in sulphurets, with a seam of barren "bastard quartz" in the middle. The ribbon rock yields $8 per ton. The foot wall is black slate and the hanging wall green-stone. A shaft has been sunk 110 feet, and drifts have been run 35 feet on the vein. The mine is in a deep ravine at the foot of Bear mountain, with steep hills on both sides. There is a 10-stamp mill, but both mine and mill are now standing idle.

At this mine an experiment was tried of roasting the rock with superheated steam. A furnace was built 20 feet high and 16 feet in diameter externally, with an ore chamber seven feet wide at the bottom, nine feet at the top, and 16 feet high. The fire boxes were on the sides of the ore chamber near the bottom, and over the grating ran a steam pipe full of orifices, through which steam could escape. The rock as it came from the mine was thrown into this furnace, and was roasted from 40 to 70 hours at a red heat with a steady discharge of superheated steam from the pipes. The heat was reduced by shutting off the steam, or increased by letting on more. The expense of roasting in this method was $2 per ton, the price of wood—the only fuel used—being $3 50 per cord. The sulphurets were completely desulphurized by this method, and the battery crushed twice as much in a day as of the run rock. The gold in the roasted ore amalgamated readily, but the quicksilver was lost. The experiment cost $25,000, and was regarded as a failure.

West Point.—West Point is a quartz mining town between the middle and the north fork of the Mokelumne river, eastward from Mokelumne Hill, from which it is 12 miles distant in a direct line, and 16 miles by the road. Its elevation is about 2,800 feet above the sea. The bed rock is granite, and the limestone belt lies three miles to the west. Quartz mining is conducted here on a peculiar system. The lodes are narrow and rich in sulphurets, and their wealth is confined chiefly to pockets. Mining and milling are separate occupations. One set of men get quartz, and another set own mills and do custom-work. The "pockety" character of the veins renders mining, with the majority, a very irregular, if not a very uncertain business; and there is not one vein in ten, even among those which have yielded large sums, that will furnish steady employment to a mill. The custom among the "pocket" miners is to hunt for pockets near the surface, and when they have found one they clean it out carefully, going down seldom more than 50 feet; and having pounded out the coarsest gold in a hand mortar, and sent the quartz containing the finer particles to a custom mill, they leave that spot and hunt for another pocket near the surface. The experience of those who have gone down in search of other pockets has not been encourging. The prospecter lays bare as much of the surface of the vein as he can, and goes picking along in search of a visible speck of gold, and having found that, he makes a careful search for a pocket in the neighborhood. When these pocket miners are successful they get a good lot of money at once, and many of them live high till it is gone, and then they may have very plain meals for three, six, or nine months, before they come on another treasure. It is said, however, that they have more money to spend than any other class of miners in Calaveras county. There are some mines here which give regular employment to mills owned by the same proprietors, but pocket mining and custom milling are followed more extensive here relatively than in any other part of the State. There are about 100 men who make pocket mining their only business. If the quartz does not yield $15 per ton it will not pay them; and they can tell by a brief examination within a dollar or two of the yield per ton. When they have found something worthy of examination, they pound up a fair sample in a hand mortar and boil it in nitric acid, as a rude mode of assay.

In the neighborhood of West Point there are several hundred veins that have had rich pockets, and one hill 400 feet across has three dozen such veins. In many of them the gold is so fine that none of it can be obtained in a hand mortar. The mining laws of West Point give 200 feet on a vein to a claim, and require one day's work every month to hold a claim.

Fisher's mill.—Fisher's custom mill, one mile southeast from West Point, has been running 11 years. It is driven by water-power, has two stamps and two arrastras, charges $7 per ton for working rock, and works two tons per day, with the services of one man. The whole establishment cost about $2,000.

Harris's mill.—Harris's custom mill, on Sandy gulch, a mile and a quarter west of West Point, has five stamps, four Brevoort pans, and three patent concentrators, and charges $5 per ton for working rock. This mill was built four or five years ago, and has been running almost constantly.

Belcher's mill.—The Belcher custom mill, a mile and three-quarters southeast of West Point, has eight stamps, but does not run regularly because of the difficulty of getting a steady supply of water.

Lacey's mill.—Lacey's mill has five stamps, and does custom work only.

Skull Flat mill.—The Skull Flat mill is two miles east of West Point, has ten stamps, goes by water, amalgamates in the mortar and in copper-plates, and uses two Hungerford's concentrators, but does nothing as yet with the concentrated tailings. The Skull Flat Company owns claims on six or seven veins, the widest not over two feet, and a depth of 100 feet has been reached in several of them. The veins run north and south, and the rock pays $30 or $35.

Carleton.—The Carleton mine, a mile and a half northwest of West Point, is on a vein a foot wide. There are two arrastras which were built in 1866, and crush and amalgamate each a ton per day.

Vance and Mina Rica.—Vance's mill, five miles west of West Point, has eight stamps, and is standing idle. The Mina Rica has two veins two feet thick, with very hard quartz, and much water in the lower levels. The mill has 10 stamps and 10 Baux's pans. The power is steam. Both mine and mill are standing idle.

Morris's mill.—Morris's mill, near West Point, has two arrastras and a roasting furnace. All the ore is roasted, and according to report the yield is $50 per ton, whereas without roasting it yields only $3.

Mosquito.—The Mosquito mine, 1,500 feet long, is five miles west of West Point, on a vein five feet wide in slate. A large quantity of rock, yielding $7 per ton, was obtained near the surface; and now a tunnel is being cut to open the mine to a considerable depth. The mill was built in 1857, and was rebuilt in 1863. It has 15 stamps, and is standing idle.

Railroad Flat mill.—The Railroad Flat custom mill, 13 miles east of Mokelumne Hill, has 10 stamps, was built in 1866, and does not get enough business to keep it running constantly. The veins in the vicinity have not been well opened.

Woodhouse.—The Woodhouse mine, 5,000 feet long, is between the forks of the Mokelumne river, 14½ miles by the road, eastward from Mokelumne Hill. The vein is four feet wide, runs north and south, and dips to the west at an angle of 45°. The walls on both sides are granite, and there is a white clay gouge, which is generally found on the foot wall. The croppings of the vein show for two or three miles. The pay quartz is white near the surface, and at greater depth is bluish and rich in sulphurets. The barren quartz is white, glassy, and coarse-grained. The first pay chimney is found 1,800 feet from the south fork of the Mokelumne river, (which is the boundary of the claim,) and 900 feet above its level on the mountain side. This chimney is 150 feet long horizontally. After an interval of 600 feet another chimney is found, and this one is 400 feet long, beyond which the lode is barren for 200 feet, and then it splits up for 1,000 feet into small branches less than a foot wide. These contain good pay, and one shaft has been sunk 100 feet to work them. Beyond this place the vein has not been prospected. The rock from the different chimneys can be distinguished by persons familiar with the mine. All the rock in the pay chimneys is worked. The vein is crossed by several trap dikes which are nearly vertical, dipping slightly to the south. They appear to bear no relation to the position of the pay chimneys; that is, the appearance of a dike is not considered an indication of the proximity of a chimney. Most of the work has been done through cross-tunnels which strike the vein 200 or 300 feet from the surface. The mine has a 15-stamp mill, which has crushed 14,000 tons of rock and taken out $140,000. After the pulp has been amalgamated in the mortar and on copper-plates, it is concentrated on blankets, and the blanket washings are ground and amalgamated in five Brevoort pans. The mill is driven by two 30-foot overshot water wheels. There is a considerable quantity of loose or "float" rock along the surface of the vein, and 3,000 feet of 11-inch iron pipe are to be obtained for the purpose of washing this float rock by hydraulic process. Much of the gold in the rock from the lower levels is lost in the sulphurets, and an agreement has been made for the erection of a revolving furnace to roast 15 tons in 24 hours, at a cost of $3 per ton.

Holmes.—The Holmes mine, 1,600 feet long, south of the Woodhouse and adjoining it, was opened in 1866. The vein is eight feet wide, and has been opened by tunnel along a length of 500 feet. The mine has a 10-stamp mill. The sulphurets contain from $300 to $1,300 per ton.

Boston.—The Boston mine adjoins the Woodhouse on the north, and was worked by an eight-stamp mill in 1853, but did not pay. The mill was washed away afterwards. Some Mexicans are now at work on the mine, with two arrastras driven by water. They obtain their rock from small rich chimneys.

Quail Hill.—Quail Hill, near the western line of the county, has a large deposit of auriferous talcose slate, containing seams of quartz and copper ore. It is not a well-defined vein, but the general course appears to be northwest and southeast, and the dip 60° to the northeast. The width is about 60 feet. Much of the surface has been washed in sluices, which paid at times very well. The total yield in sluices was not less than $25,000, and besides the gold 150 tons of good copper ore were obtained. This mine is the property of a San Francisco company, which is now building a 20-stamp mill and constructing a ditch 11 miles long from Salt Spring reservoir.*

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* Professor Silliman, in a paper read before the California Academy of Natural Sciences, said:

In the search for ores of copper which occurred in California in what is now known as the copper belt of the Lower Sierras, deposits of iron rust, as they were called by the miners, were observed at numerous points far below the range of the main gold belt of the Sierras. Several of these ochraceous deposits had been previously located by prospecting miners for gold before there was any knowledge or suspicion even of the existence of ores of copper in connection with them. It was a matter of common observation that certain gulches or water-courses in the neighborhood of these rusty deposits were rich in placer gold, having been worked for gold from an early date. The search for copper in this kind of deposit was not commercially successful, although there were shipments of green and blue carbonates of copper, red oxyd, and metallic copper, to a limited extent from both the localities here referred to, (the Harpending mine in Placer county, and the Quail Hill in Calaveras,) the metal from which was known to contain a notable value of gold and silver, stated to be about $50 to the ton of ore. This search for copper has however opened up these deposits so as to display their character in a conspicuous manner.

The rocks appear to have been originally talcose and chloritic schists, sometimes micaceous, enclosing masses of argillite, and of quartz, which appears to have been massive enough at certain points to assume the character of a vein, and parallel to the stratification, which has the usual northwestern strike and easterly dip of the region. All this mass of material, which at Quail Hill is certainly 300 feet wide, and possibly twice that, and with a linear extent exceeding 1,000 feet, appears to have been very highly impregnated or mineralized by sulphurets, chiefly of iron, with a portion of copper, zinc, and lead. The sulphurets have undergone almost total decomposition throughout the entire mass, leaving soft ochraceous deposits of a rusty red and yellow color, and staining the rocks with brilliant color, a peculiarity which the miners have characterized by the name of "calico rocks." This decomposition or oxydation of the sulphurets has extended to a point as low as atmospheric influences extend, or probably to a point where water is permanently found, which at Quail Hill is assumed to be about 170 feet below the outcrop of the mass. Dikes of porphyry and of other rocks commonly called intrusive are seen dividing these great ore channels in a direction conformable to the line of strike. But the decomposition which has

Collier.—The Collier claim, one mile southeast of Quail Hill, is similar in character to the preceding mine, and has been worked in the same manner. The total yield is estimated at $10,000. It is said that if the mill at Quail Hill succeeds one will be built here.

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affected other portions of the ore channel appears also to have changed them, for they are found to be reduced completely to the condition of kaolin and lithromarge, or kindred alterations of feldspathic rocks. The outlines of the feldspar crystals are still easily distinguished, although the mass of the dikes is completely friable.

In another paper on the mine Professor Silliman says the explorations made for copper have laid open the deposit sufficiently to disclose clearly its true nature, extent, and almost incalculable value in gold and silver. It is an ore channel, conformable like all the copper mines of the region to the line of strike of the rocks, not less, probably, than 300 feet in width, and perhaps more than twice that width. Its eastern wall is distinctly seen in the open cut, as shown in the section, dipping easterly about 70°. The western wall has never been seen, but is certainly pretty far down the slope, on the western side. The contents of this enormous channel of ore-bearing ground, so far as exposed, are entirely decomposed by chemical agency, so that they offer to the miner and geologist one of the most remarkable cases known of the total destruction of metallic sulphurets which plainly once filled the whole chasm, now converted into gossans or oxides of iron of various colors, and carbonates of copper, mingled with masses of spongy and white quartz, of talcose and chloritic rocks, rotten porphyry, heavy spar, &c., &c., all so completely changed and decayed by the causes alluded to that the entire mass yields to the pick and shovel in any direction. This extreme decay of the original contents renders the study of the mass at first a little difficult; no sulphurets of any kind remain visible to guide the eye, but in their place everywhere the results of their decomposition.

The mass is evidently a gigantic vein, the main constituent of which was a highly sulphuretted quartz, holding originally iron and copper pyrites throughout its entire mass; these sulphurets, and the quartz itself, being very uniformly impregnated at all parts with gold and silver. Examined by the battea, the pan, or the horn spoon, no part of the contents of this great ore channel fails to give abundant "prospects" of gold. Even the dry cherty croppings broken from all parts of the hill, without selection, gave an ample show of gold. The gulch at the base of the hill has always yielded good washings, and does so still, the source of which is from the ores of Quail Hill. I found the gold in nearly all the varieties of mineral contents contained in the hill, showing that any attempt at selection would be useless, and that the whole of the mass must be worked as it runs, except certain layers of soft white rock, resembling kaolin, which are probably too poor in gold to pay for working.

Extent of Explorations.—This mass has been opened by a cut driven 82 feet into it, beyond the line of the east wall, by an incline 57 feet long, at an angle of 38°, and by a shaft 42 feet below the cut, sunk in pursuit of copper ore. The shaft in the open cut explores the mass over 80 feet below the walls of the cut and nearly 150 feet below the crown of the hill. Another shaft, sunk 100 feet south of the open cut, opens the deposit to a total depth of 90 feet under the crown of the hill. Near Gopher Gulch is another shaft 62 feet deep, which passes into the unchanged sulphurets 25 feet, it is said, from its mouth, (this shaft has water in it now,) or about 170 feet under the hill.

The position of all these openings is seen on the map; but there is a tunnel, not shown on the map, run some 70 feet into the hill, on the west side, and several hundred feet (about 350 feet) beyond the western limits of the location, in which the entire mass of the hill is still seen to be completely decomposed at that part also, the tunnel having been run by the pick alone. From this tunnel I obtained spongy quartz, which prospected well for gold; but this point is very far west of the supposed productive limits of the deposit. Numerous surface-pits have also been sunk over the hill in various places for the purpose of obtaining averages, from all of which gold prospects may be obtained in the pan.

Value of the Ores.—I collected for assay and practical workings careful samples from—

1. The whole face of the open cut on both sides and end.
2. The incline shaft.
3. The south shaft.

* * * * * * * * * * *

I give here only the general results and averages, viz:

(1.) The average from the three places named above was by working tests:

Gold	$29 18
Silver	5 91
Total value per ton of 2,000 pounds	35 09
By assay, value per ton of 2,000 pounds	50 17

BRUSHVILLE.—The Austin and Hathaway mine at Brushville, half a mile south of the Calaveras river, is on a similar deposit, and has been worked down to a depth of 30 feet. The owners of the mine, who reside in San Francisco, are erecting a 20-stamp steam mill.

PLYMOUTH.—The Plymouth mine, 2,000 feet long, at Brushville, is on a deposit similar to that at Quail Hill. Mr. Heusch, a mining engineer, who examined the mine in 1865, said:

This mineral deposit may be described as a vein or belt of gold-bearing quartz imbedded in a soft decomposed talcose rock, the whole being enclosed between two nearly perpendicular walls of greenstone. The quartz, of which there is a lode of about eight feet in width,

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(2.) Ten (10) small samples collected at various points in the open cut, with a view to determine where the ore was richer or poorer, (the details of which are appended,) gave—

Gold	$17 08
Silver	5 82
Total	22 90
Assay value of same	24 70

(3.) A large lot of 2,843 pounds of ores collected some time since, under direction of Messrs. Attwood and Peachy, were carefully worked by Mr. Lewis Blanding, giving by working tests an average of—

Gold	$35 08
Silver	14 38
Total	49 46
Assay value	82 65

(4.) Averaging these three independent sets of returns, as we have for the general average—

Gold	$30 11
Silver	8 68
Averaging total working tests	38 79
Average assay value	52 51

An inspection of the tabulated results given in detail with this report will show that the silver is very unequally disposed, being found in greatest quantity in the incline shaft or near its mouth. If we view the results from the least favorable side, even accepting the lowest single averages as those most likely to be obtained in working in the large way, it is impossible to avoid the conclusion that the whole mass of the ores at Quail Hill, so far as explored, exceeds the average gold tenor of most of the best quartz mines of the State of California.

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COST AND MODE OF TREATMENT.—At Quail Hill the water-power is sufficient to move 100 stamps, as the water is delivered under an estimated pressure of about 200 feet head. The only water in all the region is at the command of the owners of Quail Hill. The reservoir has a present area of over 650 acres, and the right of flowage, by the terms of its location, of an elevation of 15 feet more than its present height. A line of survey is now being run for a ditch, estimated to be of about ten (10) miles in length, to convey the water to Quail Hill, and also of the line marking the area of flowage at an elevation 15 feet higher than the present. This reservoir fills the valley known as Salt Spring Valley.

With these facilities it is estimated that the cost of treatment of the Quail Hill ores will not exceed 70 to 80 cents per ton, including the cost of extraction and delivery at mill. The mode of treatment is based on the condition of the gold, which is all free, viz: amalgamation in battery, double discharge; moderately coarse screens, No. 2 or No. 3; amalgamated copper aprons and riffles; large settlers to collect amalgam and mercury; an ample flow of pure water to aid in settling the residuum, and large slime pits to retain the tailings, are the main features. As experience in the management of the ores teaches us better methods, such improvements as are thus warranted may gradually be introduced. Blankets may form a part of the system, following the copper inclines.

I would not advise an estimate of value exceeding $10 per ton, net saving, or say 40 and 50 per cent. of the demonstrated value. The residue is not lost, and the ample head and flow of water will permit the company at any future time to set up a pan mill, or any other approved mode of working over the tailings, provided the tailings are retained as herein advised, and should be found valuable.

occupies the western part of the vein, while the remaining space is filled with the auriferous talcose rock, the whole forming a regular channel of gold-bearing matter of about 40 feet in width, many hundred feet in length, and doubtless many hundred feet in depth. It is in fact a wide chasm, running through a hill several hundred feet in height, and filled with auriferous quartz and other gold-bearing matter.

Mr. Heusch estimated that there were, within 300 feet of the surface, in a length of 600 feet, 214,185 tons of auriferous matter that would yield $10 gross and $4 net per ton. There is a 10-stamp mill on the mine, and it began to run on the 1st of September. The estimated yield is $8 per ton, and the expense $2.

LAMPHEAR.—The Lamphear mine, 1,800 feet long, is two miles southeast of Mokelumne Hill, is on a vein which is four feet wide, and has been worked to a depth of 45 feet and to a length of 100 feet. Six hundred tons of rock have been worked, and some of it was quite rich. There is an eight-stamp mill on the mine.

CADWALLADER MILL.—The Cadwallader mill has three stamps, was built for prospecting, and is not at work.

FRENCH MILL.—The French mill, at Rich gulch, six miles east of Mokelumne Hill, was built two years ago, has 15 stamps, and is standing idle.

MCGLYNN'S MILL.—McGlynn's six-stamp mill, erected at San Andreas to crush quartz, is being moved to Irvine's claim, on the old channel, to crush cement.

CHEROKEE.—The Cherokee mine, 1,700 feet long, west of Altaville and a quarter of a mile west of the line of the mother lode, was discovered by some placer miners, who washed the gravel and clay from the surface of a vein of decomposed quartz, and dug up the carious quartz filled with auriferous clay and washed that too. The discoverers, having taken out $27,000, sold to others, who got $9,000 and then leased it to a gentleman who obtained $30,000; and after him came a party who got out $25,000. The mine is now owned by a citizen of San Francisco, who has a 16-stamp mill now idle on it. The gold is coarse and is in pockets, and most of the rock does not yield more than $2 or $3 per ton.

SAN DOMINGO.—At San Domingo a rich auriferous pocket was found in limestone, the rock yielding $1,500 per ton. After most of the gold-bearing quartz was extracted the mine was sold to a San Francisco company for $10,000. They never obtained any return for it.

MURPHY'S.—At Murphy's a similar pocket was found and a mill was erected at a cost of $40,000. Although water could have been obtained in constant supply, it was driven by steam. The rich rock was soon exhausted, and the mill was sold and removed.

At Murphy's there is a three-stamp mill now running, called the Valparaiso mill.

At Cave City some rich rock was found, and a mill was built, but it has since been moved.

At El Dorado there is a mill.

CRISPIN.—The Crispin mine, 2,400 feet in length, two miles west of Murphy's, is on a vein which runs east and west and dips to the south at an angle of 80°. A shaft has been sunk to a depth of 100 feet, and drifts have been run 150 feet on the vein. The width of the lode is six feet, but the pay is confined near the surface to a very narrow seam next the hanging wall, though it widens as it goes down. The pay chimney is only 30 feet long on the surface, but at the 100-foot level the drifts have not reached the end in either direction. The walls are of slate, with a gouge of auriferous talcose slate. There is a water-wheel for pumping and hoisting, but no mill. A custom mill crushed 225 tons and obtained an average of $20 per ton.

A quartz lode running northwest and southeast passes through Murphy's and Douglas Flat, and has been struck at many places by placer miners. At the surface it consists of decomposed quartz, and all along its line quartz boulders are found, and some of them have been rich.

ISABEL.—The Isabel mine, about half a mile westward from Vallecito, yielded $50,000 in a single pocket. A mill was erected, but as it did not pay it was moved away, and the mine is not worked.

CALAVERITAS.—The Calaveritas mill, erected about 10 years ago by a French company at a cost of $110,000, has been moved away. It never crushed a pound of quartz from the mine which it was built to work. Before it was completed the pocket supposed to represent the average richness of the vein was exhausted, and as no auriferous rock could be found afterwards, the mill had nothing to do.

ALBION.—The Albion mine, in Salt Spring valley, three miles west of Copperopolis, has been worked for three years with a 10-stamp mill. The average yield is about $6 per ton, leaving very little profit. The gold coins $11 per ounce.

THORPE'S.—Thorpe's mine, 600 feet long, six miles west of Angels, is on a vein which runs northwest and southeast, and is similar in its gangue to the Bovee mine. The thickness of the lode is three feet, and the yield is $10 per ton. The rock is crushed and amalgamated by two arrastras, driven by a water-wheel 24 feet in diameter.

The Ratcliffe mine, 400 feet long, is two miles southwest of Angels, on the Copperopolis road. The vein is from four to six feet wide, and the rock is quartz mixed with talcose slate. This mine has been worked at intervals for three or four years, but steadily for 18 months, by one man, who throws the quartz upon the road, where it is ground fine by the heavy wagons passing over it, and then he shovels the dust into his sluice, which runs along the road, and catches the gold. This is the only lode mine worked on this plan in the State.

CARPENTER.—Adjoining the Ratcliffe mine and on the same vein is the Carpenter mine, on which a five-stamp mill was erected in 1855. The mill was moved to Angels, and the mine is now lying idle.

PURNELL.—The Purnell mine, 600 feet, adjoining the Carpenter, has been worked for five or six years, and a 10-stamp mill is now going up on it.

SECTION VI.

AMADOR COUNTY.

Amador, one of the smallest mining counties of the State, and also one of the most prosperous, lies between the Mokelumne and Cosumnes rivers, extending from the summit of the Sierra to near the plain, with a length of 50 miles and an average width of 14. It owes its prosperity chiefly to the mother lode, which crosses the county about 12 miles from the western boundary, and has within three miles three mines, which have all been worked continuously for 15 years, have probably produced not less than $8,000,000, and form the most remarkable cluster of quartz mines on one vein in the State. Twelve miles further east, near Volcano, there is another rich quartz mining district, which has some peculiar features. Otherwise, the county has not much wealth. It has no great thoroughfare leading across the mountains, no place of fashionable summer resort, no productive mines of copper, no extensive hydraulic claims, few rich surface placers, and no quarries of marble or deposits of plumbago.

The agriculture of the county is prosperous but not extensive. The farmers do not aim to do more than supply the home demand, except in wine, and for that there is no regular market as yet. The county has a large number of vineyards, and they are cultivated with care. Timber is abundant in the eastern part of the county, but scanty in the western.

Near the eastern boundary, at an elevation of 10,000 feet above the sea, is Silver lake, a mile long and a half mile wide, surrounded by beautiful scenery.

It will probably become a favorite summer resort at some future time, when better means of access are provided.

A road following up the main divide between the Cosumnes and Mokelumne rivers, in this county, leads across the Sierra Nevada through the Carson pass. It was made at considerable expense, but there is not much travel on it.

The most remarkable topographical feature of the county is the Jackson butte, which rises 1,200 feet above the adjacent country, five miles from the county seat. In form it is a regular cone, with a sharp peak, and there are no signs that it ever had a crater, although it has often been spoken of as an extinct volcano.

Jackson creek, Sutter creek, Dry creek, and Indian creek, which drain the county between the rivers that serve as boundaries, all go dry in the spring. Water is supplied by 28 ditches, with an aggregate length of 433 miles and an aggregate cost of $1,154,500. The only large ditches are the Butte, Amador, and Volcano ditches.

The county debt is $100,000, and the State and county taxes together are $3 20 on the $100 of assessed value.

Jackson, the county seat, formerly had rich placers in its neighborhood, but now depends chiefly upon quartz. Sutter Creek is the chief town and business centre of the county. It ranks next to Grass Valley for the production of quartz gold. Amador and Drytown are other towns situated on or near the mother lode. Volcano, the only placer mining town in the county now producing much gold, is on the lime belt, and has diggings very similar to those of Columbia and Murphy's. Butte City, which depended on shallow placers and was once populous and prosperous, is now exhausted and abandoned. Buena Vista, Forest Home, Willow Springs, Slabtown, Clinton, and Aqueduct City are also worked out. Tiddletown has a few good hydraulic claims, and Lancha Plana several that pay a little more than expenses. Ione City is surrounded by a fertile farming land, and there are more than 1,000,000 vines in the vicinity.

The quartz mines of the county, as a class, were unprofitable previous to 1858, but since that year they have been steadily improving, and the white population has been increasing. It is estimated by county officers who have occasion to make close observation, that 1,000 Chinamen have left the county this year.

Several high ridges or divides that come down from the Sierra are supposed to consist chiefly of gravel with rich auriferous strata in them, but there is no proof of the correctness of this theory save the general resemblance of these ridges to others known to be auriferous.

VOLCANO.—The town of Volcano, situated on the lime belt, 12 miles eastward from Jackson, was so named because it is in a deep basin, and the first miners at the place supposed they were in an extinct crater. This supposition has not been accepted as correct by scientific men generally who have visited the place, although there are many marks of volcanic outflows in the neighborhood. The diggings here are very similar to those of Murphy's and Columbia on the lime belt further south, and the same difficulties of drainage have been experienced.

On China Hill, south of Volcano, are the following hydraulic claims:

Ross & Co., 300 by 100 feet, have been at work since 1855, and have made $5 or $6 per day. During the last three years three men have been employed. Their claim is 80 feet deep.

Goodrich & Co. have 200 by 100 feet, have worked for 12 years, and have not found very good pay. The claim is 80 feet deep, and will last four or five years. There are two men at work.

Farrin & Co. have 300 by 100 feet, and are working to a depth of 20 feet, below which they have no drainage, and must hoist their dirt. The claim has been worked at intervals for 13 years, and now employs three men.

The Murphy & Co. claim is 300 by 100 feet on the surface, and 100 feet deep, has paid from $8 to $12 per day to the hand until within the last year, and lately has not paid expenses.

There have been a number of other claims on China Hill, but they are either abandoned or of little note.

At the mouth of China gulch are the following dump-box claims:

Foster & Co. have 400 by 150 feet, employ six or seven men, and have been at work since 1853, excepting from 1858 till 1862, when they were idle, waiting for the completion of the open cut to give them drainage. In 1866 they took out $8,500 clear of expenses. The claim will last three years, and is worked only in the summer.

Sullivan & Co. have 200 by 150 feet, commenced work in 1865, and have made $3 or $4 per day to the hand. They employ four men, and their claim will last two years.

Armstrong & Co. have 800 by 150 feet, and employ five men. They commenced work in 1852, and made good pay till 1857, when work was stopped for want of drainage. In 1861 they began again, and did well till 1866, in which they only paid expenses. This year they are again getting good pay. The claim will last seven or eight years. It is worked only in the summer.

Hayt & Co. have a very small claim.

On Mahala Flat, Goodrich and Co. have a hydraulic claim, 200 by 100 feet. They have worked since 1856, and have made wages until lately. Two men are employed.

On Volcano Flat are the following dump-box claims, which are worked only in summer:

Terrill & Co. have 400 by 100 feet, and employ six men. The claim has been worked since 1861, and has paid very well.

Green & Co. have 300 by 100 feet, employ five men, have been at work since 1861, and have made good pay.

The Italian claim has been worked since 1865, and pays well.

Cerrelli & Co. have been at work since 1865, and have obtained good pay.

Much ground now occupied for gardening purposes in Volcano will be mined out within three or four years.

QUARTZ REGULATIONS OF AMADOR.—In Amador county, each district has its own mining regulations for quartz, as well as for placer mining. If a claim is not within the limits of any district, it may, according to custom, be recorded in the nearest district, and held under its laws.

In the Volcano district a lode claim for one person is 200 feet on the vein, and 75 feet on each side.

In the Pinegrove district a claim for one person is 300 feet, and 100 feet on each side, and in this, as in the Volcano district, one day's work is necessary each month to hold each share.

In the Volcano, Pinegrove, Clinton, and Jackson districts a company's claim, no matter how large, may be held for a year by doing work to the amount of $500, posting a notice on the claim, and filing notice with the recorder that such work has been done.

In the Jackson district, if the company is a small one, it may do work to the amount of $20 for each share, and this will hold the claim for a year.

There are no pocket veins in Amador county similar to those at West Point, in Calaveras county, or at Bald mountain, in Tuolumne. The limestone at Volcano is full of bunches of quartz, but they are not large enough to work, and there are no regular veins.

In the vicinity of Volcano, most of the quartz veins cut across the slates at an angle of 45°, and run between 15 and 30° east of north.

Elvan courses are abundant in the limestone.

QUARTZ VEINS ABOUT VOLCANO.—The quartz lodes in the vicinity of Volcano generally run northeast and southwest, cut across the slates, contain considerable portions of antimony, arsenic, lead, and zinc, with traces of tellurium, and are intersected by elvan courses, which run north and south, and dip to the west at an angle of 70°. The elvan courses are usually from one foot to four feet in thickness, and the intervals between them are very irregular. Quartz veins crossed by elvan courses are usually poor near the intersections. Those lodes which run with the courses are very spotted, rich in some places, and poor in others. Where the quartz is thick in these veins, it is richer than in the narrow places. Pockets and coarse gold are rare.

MARLETTE.—The following mines are on the mother lode or its branches. The Marlette, 800 feet long on the mother lode, near the Mokelumne river, is reputed to be rich, but unprofitable on account of the high cost of working. There is a 10-stamp mill which has been idle a year and a half.

CONEY.—The Coney mine, 800 feet long, is half a mile south of Jackson, on a vein which is 30 feet west of the main mother lode, and can be traced for 10 miles by its croppings. The dip in this mine is 72° to the northeast. The lode is nine feet wide. The deepest workings are 200 feet from the surface, and drifts have been run 300 feet on the vein, all of which, so far as examined, is pay rock. For 150 feet from the surface there is much slate, and lower down the vein-stone is all quartz. Near the hanging wall is found ribbon rock, containing some free gold, which is rare elsewhere. Five per cent. of the vein matter, and in spots 20 per cent., is sulphurets, which yields $7 50 per ton of unconcentrated rock, and $200 per ton of clean sulphurets. The free gold yields $6 per ton, so the total yield may be put down as $13 50 per ton. The mill has 16 stamps in four batteries. Hendy's concentrater and sluices are used in concentration. It was necessary for the purpose of working this mine with a profit to have a chlorination establishment, which has been erected. The furnace is 17 feet long, 12 feet wide, and 8½ feet high outside, with a smoke-stack 25 feet high. There are two reverberatory hearths one over the other, and each 10 feet square, with a capacity to hold a ton and a half. There are 12,000 brick, fifty perch of stone, and five cubic yards of soapstone in the furnace, which it is supposed will last three years. A charge is roasted 12 hours in each hearth, so that the furnace has a capacity to roast three tons in 24 hours. The total cost of the establishment was $2,100, and the cost of the chlorination is estimated at $25 per ton of sulphurets. A cord of wood costing $4 is consumed in roasting three tons.

BLUE JACKET.—Adjoining the Coney on the north is the Blue Jacket mine, 1,000 feet long. The shaft is down 100 feet deep. Only $1 25 per ton of free gold has been obtained, and $100 per ton from the concentrated sulphurets. No work is being done now.

TROWBRIDGE.—The Trowbridge adjoining has 1,200 feet, and is at work, but is not crushing. The Adams mine on the same vein is not crushing.

ONEIDA.—The Oneida mine, 3,000 feet long, is a mile and a half north of Jackson, on the mother lode. The course there is nearly north and south, and the dip to the eastward from 65° to 80°. The main shaft is 500 feet deep, and drifts have been run about 600 feet on the vein; the width is from 10 to 40 feet; the foot-wall is slate, and the hanging wall greenstone. The quartz is white and blue, with some ribbon rock which contains more free gold than is found in other parts of the vein. There is a black putty gouge on the foot-wall. There are two pay chimneys, which dip to the north, and all the rock in them is pay. The quartz within six or eight feet of the hanging wall yields $30 or $40 per ton, but the average of all worked is $17 50 per ton. All the ore heretofore worked has been taken from one pay chimney, which is 300 feet long, horizontally, at the surface, and 400 feet long at a depth of 400 feet. The vein pinches out at the ends of the pay chimneys, so that there is very little barren rock. The walls are, in places, as smooth as glass. The mine is opened so that there is ore enough in sight to supply 60 tons per day for five years.

The mine was discovered in 1851 by a hunter who chased a rabbit to some large quartz croppings, in which, after a brief examination, he found rich specimens of gold. Since then work has been prosecuted continuously and with almost constant profit. Three or four mills were built successively, and the mine has changed hands a dozen times. Many thousand tons of quartz have been crushed from it, but there is no record of its early yield. In eight months preceding June 1, 1867, $135,000 were taken from 7,710 tons, at an expense of $5 per ton, leaving $12 50 net per ton. The present owners have not had possession long, and they have expended much in opening the mine and putting the mill into good condition. The superintendent says that if the proprietors had not had a considerable sum of money at their control after purchasing the mine, they would have been ruined, since without the repairs and the new shafts and levels they could have got nothing.

The mill has 60 stamps, and is driven by steam. Amalgamation begins in the battery, and continues on copper aprons below; then there are shaking-tables, blankets, copper sluices 60 feet long, blankets again, and sluices. The screen is No. 4, punched in slots. One per cent. of the ore is sulphurets, which, when concentrated, yield $200 to the ton.

Hayward.—The Hayward mine, one of the most valuable gold mines of California, is 1,800 feet long, and includes two old claims known as the Eureka and the Badger. The average width of the vein is 12 feet, and the dip 75° to the east. All the rock is taken out. The hanging wall is of hard serpentine; the foot-wall is of slate, polished smooth. The foot-wall swells so that the mine closes entirely up behind the workmen, and saves the trouble of leaving pillars, and prevents any apprehension of caving in. There is a continuous black putty gouge. There is only one pay chimney, and that is 500 feet long, horizontally, on the surface, and at 1,200 feet below the surface the supposed length is 600 feet. The walls come together at the ends of the pay chimney, which dips to the north at an angle of about 80°. The deepest incline is 1,230 feet deep, the greatest depth reached in the mines in California. The surface of the earth at Sutter creek is 900 feet above the sea; so the lowest drifts in the Hayward claim are 300 feet below the sea level. Work was commenced in 1852, and has been continued uninterruptedly since. A 10-stamp mill was erected on the Eureka claim in 1852. A new mill, with 20 stamps, was erected in 1856, and 20 more were added the next year. A 10-stamp mill was built on the Badger or southern claim in 1854, and six more stamps were added in 1857. Mr. Hayward, the present owner, obtained a controlling interest in the Badger in 1854, purchased the Eureka in 1858, and became sole owner of the Badger in 1859, thus consolidating the two claims. There are three shafts—the southern 760 feet deep, the middle 960, and the northern 1,230.

At the level of 760 feet a pillar has been and is to be left to catch the water which comes from the surface. About 45,000 gallons were hoisted daily in buckets in the early part of June—25,000 from the southern and 20,000 from the northern part of the mine. In February and March the quantity was twice as great.

There are two mills now, with 56 stamps, and with capacity to crush 80 tons per day, but at times much quartz is sent to custom mills. The gold is nearly all free, and the amalgamation is effected chiefly in the mortar and on copper aprons. The sulphurets are saved in sluices. For the first 200 feet the Badger mine did not pay, and it was with the utmost difficulty that the mill was kept going, but the vein appeared to be getting wider and the quartz richer, and work was continued, with some trust from the laborers, until the receipts exceeded the expenses; and soon after the two claims were consolidated the Hayward took a leading position among the mines of the State. Within 500 feet of the surface the average yield did not exceed $10 or $11 per ton, and now it is, according to report, $27, with a wide vein and 125,000 tons of ore in sight—enough to keep the two mills going for five years. The proprietor of the mine has a great fear of being suspected of seeking publicity, and he refuses to give information about the details of his receipts or expenses, or even to communicate his experience in or his opinions about quartz mining. It is, therefore, necessary to rely upon the statements of persons not connected with the mine for the yield; and they say the total yield has been $6,000,000; the gross yield last year per ton $27; the net yield, $22 per ton; the amount of rock worked in 1866, 30,000 tons; and the profit of that year, $660,000. Much rock is at times sent to custom mills to be reduced. The quartz in sight, it is estimated, will yield $3,375,000 gross, and $2,750,000 net.

Sixty miners are employed, 12 blacksmiths and engineers, and 25 others as feeders, amalgamaters, teamsters, &c. The miners and laborers in the mill work by two shifts, a day shift and a night shift of 10 hours each; and at the end of each week the shifts change, so that each man works in the night-time one week and in the day-time the next. The rock is carried from the mine to the mill on a tramway.

Railroad.—The Railroad mine, 800 feet long, has been worked four years, has produced $70,000, and has had much rock which yielded $15 per ton. A depth of 340 feet has been reached, and drifts have been run 300 feet on the vein. There is no mill connected with the mine.

Loring Hill.—The Loring Hill, 700 feet abreast of the Railroad mine, on another branch of the mother lode, was worked for ten years, paid from $5 to $12 per ton, and has been idle for five years. Work is soon to be resumed. A depth of 150 feet was reached.

Wildman.—The Wildman, 1,130 feet long, has reached a depth of 530 feet and has run 200 feet on the vein. There is a 12-stamp mill, which is busy at custom work.

Lincoln.—The Lincoln mine, 2,078 feet long on the mother lode, is half a mile north of Sutter creek. The course of the vein there is north 17° west, the dip about 75° to the eastward, and the width six feet. A depth of 669 feet has been reached in one shaft and 270 in another; and drifts have been run 400 feet on the vein. There are two pay chimneys, one 150 and the other 250 feet long. They dip slightly to the north, although their lines are irregular. The mine has been worked since 1851, with the exception of a couple of years. About 3,500 tons have been extracted annually while the mine was worked. Work was stopped in November, 1866, and is to be resumed next year. There is a 20-stamp water-mill, which is now doing custom work for Hayward. The mill catches 90 per cent. of its gold in the mortar, 3 per cent. on the apron, 5 per cent. on the shaking table, and 2 per cent. on blankets.

Comet.—The Comet mine, on the mother lode, north of Sutter creek, is 750 feet long, and a depth of 145 feet has been reached. The mine is now being opened to a greater depth.

Herbertville.—The Herbertville mine, 1,200 feet long on the mother lode, a mile north of Sutter creek, was worked from 1851 till 1859, but never was profitable, though some good quartz was found. A depth of 600 feet was reached. There was a 30-stamp mill, which was burned down.

Keystone.—The Keystone mine includes claims on two distinct lodes—3,000 feet on the Keystone, which runs north 48° west, and dips eastward at an angle of 52°; and 840 feet on the Geneva, which is 280 feet east of the Keystone, has a dip of 64°, and a width varying from 3 to 7 feet. The foot wall of the Geneva vein is slate, and the hanging wall is a hard greenstone. The average width of the Keystone is 10 feet. Professor Ashburner, in a report on the mine, says "the wall of this (Keystone) vein on the west is generally hard, well-defined, and regular; on the east it is softer, and frequently incorporated with the quartz. The ground in many places is loose, and the vein seems to have been subjected to great pressure, crushing the quartz to powder." There are many horses of hornblendic slate in the Keystone vein, on which vein most of the work is now being done. The quartz is mixed with black and green talcose slate, and the green contains good pay. The Geneva vein contains good pay rock, but it is harder than the Keystone. It is calculated that the two veins, if they maintain their present dip, will unite at a depth of 1,800 feet. The deepest shaft is down 375 feet, and drifts have been run 450 feet, in pay all the way. The mine was opened in 1851, and has been worked continuously since. The total quantity of rock worked has been 44,000 tons; the average yield per ton, $16; the total yield, $700,000. The croppings were rich. The present mill has twenty stamps, and is driven by steam. Most of the gold is caught by amalgamation in the mortar, and on the copper apron below the screen; next to which are blankets, and the tailings from them are ground in Hepburn and Peterson pans, and amalgamated in settlers; and the pulp is concentrated again for sulphurets in Prater's concentrater. The rock contains one and a quarter per cent. of sulphurets which are gold. The present average yield is $16 per ton, and 17,000 tons have been worked in the last two years. The yield from December 8, 1865, till December 21, 1866, was $135,333 30; the dividends, $51,300; the amount spent in building, $34,000; the current expenses, $50,033 30; and the total profits, $85,300.

Spring Hill.—On another branch of the mother lode, abreast of the Keystone, is the Spring Hill mine, 1,200 feet long, which has been worked to a depth of 350 feet, has turned out 50,000 tons of rock, but has paid little, if anything, beyond expenses. There is a 30-stamp mill, which is now idle, with the exception of five stamps employed on custom rock.

Amador.—Adjoining the Spring Hill on the north is the Amador, which is 1,300 feet long and was worked in early days to a depth of 240 feet.

Bunker Hill.—The Bunker Hill, 1,200 feet long, has been at work since 1854, and has reached a depth of 350 feet. The vein is six feet wide, and the rock yields $10 per ton, leaving $3 profit. There are several faults in the lode within the limits of this claim. The mine and an eight-stamp mill belonging to it are the property of gentlemen residing in San Francisco and in Boston.

Hazard.—The Hazard mine, 800 feet long, is not worked now, but has produced 5,000 tons of rock, some of which yielded $15 per ton. The vein is three feet wide, and there is an eight-stamp mill.

Loyal.—The Loyal, 600 feet, has a 20-stamp mill, and both mine and mill are idle.

Italian.—The Italian mine, 340 feet long, has a six-stamp mill, and has crushed 2,000 tons of quartz, but is now idle, and has been for two years. It paid very well near the surface.

Seaton.—The Seaton mine, a mile and a quarter east of Dry Town, is 1,200 feet long on the mother lode, which there averages 30 feet wide. About 10,000 tons of quartz have been worked, yielding $9 per ton, and leaving a small profit. There is a 40-stamp mill which has a 40-foot wheel to drive it when water is abundant, and a 60-horse power steam-engine for other times. The mill is now idle waiting for the further opening of the mine. The deepest works are 500 feet from the surface. The mine was purchased a couple of years since by a San Francisco company, which has expended $150,000 in improvements.

Potosi.—The Potosi mine is 800 feet long, has been worked since 1852, and has a good pay chimney four feet wide. There is a 16-stamp mill on the mine.

Webster.—The Webster mine, 600 feet long, was worked for a long time, but the rock paid only $7 per ton leaving no profit, so the mill which once belonged to the mine was moved away and work was stopped. The average width of the vein was six feet.

Plymouth.—The Plymouth mine is 1,200 feet long on the main mother lode and has other claims on branch veins. The lode is twelve feet wide there on an average, and the rock now worked yields $8 per ton, at a depth of 400 feet.

The quartz obtained within 300 feet of the surface paid $15 per ton. There is a 15-stamp water-mill driven by a water-wheel 38 feet in diameter.

ENTERPRISE.—The Enterprise mine has a 10-stamp mill, which commenced to run in the spring of this year.

RICHMOND.—The Richmond mine, 1,200 feet long, is being prospected, and its 10-stamp mill is standing idle.

MEADER'S SULPHURET WORKS.—Meader's sulphuret works, a mile and a half east of Sutter creek, was fitted up with machinery invented by Mr. Ambler, consisting of a sizer, grinder, concentrator and pan, but the establishment has not been successful. The grinder is constructed somewhat like a coffee-mill, of cast iron, with ridges running downward on a cone working against other ridges running in a contrary direction in a hollow cone.

ROSE.—Rose's mill has eight stamps, and was formerly occupied as the sulphuret establishment of Mr. Thoss. It was standing idle in June for repairs. The mine which is to supply it with quartz had been opened at that time to a depth of 150 feet and to a length of 60 feet.

WOLVERINE.—East of Jackson, on another vein, is the Wolverine mine, 1,000 feet. It was opened by a tunnel 100 feet long, and 500 tons yielded $4 40 per ton of free gold. No work is being done now.

KEARSING.—The Kearsing mill was first erected at Big Bar on the Mokelumne river in 1855, and was moved in 1863 to the vicinity of Jackson to be used as a custom mill. It has four stamps and Ambler's pan.

HINCKLEY.—The Hinckley mine, near the town of Jackson, is on a vein not traced elsewhere. The claim is 600 feet long, and it has been opened to a depth of 50 feet. There are two veins—one from three to seven feet in width, and the other pinches out. About $15,000 have been taken out in a hand mortar; and some rock crushed in a mill yielded $12 per ton. Much of the gold is black or purplish, offering a singular contrast to the white quartz in which it is found. The vein was first struck in digging a cellar, and the gold-bearing quartz was in June still visible in the cellar wall. Some of the gold is found in little sheets or leaves rolled up or tied up in a very singular and unaccountable manner.

ATCHISON.—Atchison's mill, one mile north of Jackson, built in 1867, has 20 stamps, and is employed on custom work. It was built to work an unopened mine, but after opening no pay was found.

TUBBS.—Near the Atchison mill is Tubbs' mill, which was moved, in 1866, from the vicinity of San Andreas. It is idle now, waiting for the opening of the mine which it is to work.

PAUGH.—Paugh's mine, 1,000 feet long, is seven miles east of Jackson. The vein has not been found beyond the limits of this claim. The course is east-northeast by west-southwest, with a dip to the southeastward. The average thickness is seven feet, and the walls are slate on both sides. There is no continuous gouge, but such as there is is yellow in color. The mine has been worked for two years and a half and a depth of 175 feet has been reached. Drifts have been run on the vein 300 feet. The quartz has paid from the beginning, and the average yield without selection is $10 per ton, and after selection $12 or $15. The richest quartz is found near the foot wall. The gold is fine and there is no "specimen rock." There is but little pyrites The mill has 10 stamps driven by steam, and was built in 1865. The pulp is amalgamated in the battery and in copper plates.

UNION.—The Union or Steen mine, a mile and a quarter south of Pine Grove, is 3,000 feet long on a vein which is eight feet thick on an average, and runs northeast and southwest with a dip of 60° to the southeast. The rock is a blue ribbon quartz, richest near the sides. One and a half per cent. of the vein matter is sulphuret of iron, lead, zinc and antimony, and these sulphurets when concentrated assay from $200 to $6,000 per ton. About 600 tons of rock have been worked, giving a yield of $11 50 of free gold per ton; and the rock heavily charged with sulphurets yielded $4 50 in the battery and from $22 to $150 in the pan. The vein has been opened to a depth of 197 feet and to a length of 130 feet. There is a nine-stamp steam mill built in 1857. The proprietor of this mill has used a saturated solution of cyanide of potassium, bulk for bulk with the quicksilver, and found a gain of 23 per cent. in the yield of the gold. The potassium seems to loosen the sulphurets, set the gold free, and keep the quicksilver clean.

Tellurium.—The Tellurium mine, near Pine Grove, owned by a San Francisco company, is 3,000 feet long on a vein which runs north 40° east, dips to the east at an angle of 75°, and is seven feet wide. The walls are of slate, hard on the east and soft on the west. The quartz is bluish in color, and the pay, which is one-third of the vein, near one wall or the other, skipping from side to side, is charged with seven per cent. of blue sulphurets of iron, lead, antimony and arsenic. The superintendent of the mine says it contains tellurium in considerable quantities, but others say the proportion of that metal is very slight. There are two pay chimneys, each 130 feet long horizontally. A cross tunnel 1,200 feet long strikes the vein 250 feet from the surface, and drifts have been run 700 feet on the vein, or on its supposed course, for its place appears to be usurped by a porphyritic dike. The pay rock above the level of the tunnel has been worked out and the drift is being extended in the hope of striking another pay chimney. The rock yields $25 per ton in free gold, and the concentrated sulphurets have been sold at $200 per ton. The mill was built two years ago, has 10 stamps, and amalgamates in a mortar and on copper plates. It is standing idle, waiting for the opening of a new body of pay quartz. The superintendent of this mine has been in the habit of making large assays by mixing pulverized ore with 10 per cent. of sawdust or charcoal, and moulding with a little clay and water into bricks which, after drying, are burned with the assistance of very little fuel save that in the bricks. He considers this a very satisfactory method of burning out the sulphurets, and thinks there are some ores which would pay for working altogether by this method.

Anaconda.—The Anaconda mine, near Pine Grove, is 900 feet long on a vein four feet wide. A shaft has been sunk 90 feet and drifts have been run 100 feet. Some of the rock has been crushed at a custom mill and has paid well. The mine is now being opened to a greater depth.

Thoss.—The sulphuret mill of W. H. Thoss, near Pine Grove, is the only establishment of the kind in the State, and he is the only man who has any repute for possessing exclusively any valuable metallurgical secrets. He pays high prices for sulphurets, and works them without wasting, and in a few instances he has worked sulphurets at a fixed price per ton or on shares. Those for whom he has worked speak well of the result obtained, and the general impression in the neighborhood is favorable to his claims. He says that his process is valuable only where there are sulphurets; that he can extract 90 per cent. of both gold and silver at a total expense of $6 per ton; and that he would rather have new than old sulphurets. In the chlorination works roasting is necessary and the silver is lost. Among those who speak well of Mr. Thoss are the proprietors of the Sirocco mine, who paid him $80 per ton for working sulphurets, and returned them $220 per ton. The mill consists of a crocodile crusher which reduces the rock to the size of peas, and of two cast-iron pans 10 feet in diameter, cast in sections and enclosed in wood. These pans have each four heavy greenstone mullers which make 25 revolutions per minute. The pans take charges of 750 pounds of crushed quartz or sulphurets and reduce them to impalpable powder in five or six hours. From the pans the pulp runs into a lower chamber into which nobody but the proprietor enters, and there his secret process of amalgamation is accomplished. He says that he makes from $10 to $600 per ton from the material which he purchases, and that the supply of sulphurets offered to him for sale is five-fold more than he can work. He does not enlarge his establishment because it would be necessary to communicate his secret to others, and he is unwilling to do that.

Crafts.—The Crafts mine, 1,800 feet long, is supposed to be on the same vein with the Anaconda. The course is east-northeast and west-southwest, and the dip 60° to the southeast. A shaft has been sunk 200 feet, and drifts have been run 125 feet on the vein. The pay chimney dips 60° to the northwestward. About 20 per cent. of the vein matter is represented to be sulphurets of iron, copper, zinc, and tellurium. There is no mill, and little work has been done.

Golden Eagle.—The Golden Eagle or Vaughn mine, two miles and a half southwest of Volcano, is 900 feet long on a vein which runs north and south, crossing the slates, and is three feet wide. A tunnel has been run 375 feet on the vein, and a depth of 170 feet has been attained. The rock yields $15 per ton, and the total production has been $50,000. The mill was built in 1858 and rebuilt in 1865. It has 10 stamps, and is driven by water. The mine and mill have been worked together, although there are some owners on the mine not interested in the mill.

Belden.—The Belden mine, owned by the California Furnace Company, near Pine Grove, is on a vein which averages 18 inches in thickness, and runs north-northwest. The shaft is down 250 feet, and drifts have been run 200 feet on the vein. The rock is rich, but it pinches out in places. The mine has been worked for 10 years, sometimes at a profit, and sometimes at a loss. There is a five-stamp mill and a roasting furnace in which the rock was roasted as it came from the slopes.

Pioneer.—The Pioneer mine, three miles from Volcano, is on a vein 18 inches wide between hard granite walls. The rock is rich in sulphurets of copper, arsenic, and antimony. The shaft is down 80 feet, and drifts have been run 250 feet on the vein. The rock yielded $40 of free gold near the surface, but that from the deeper levels did not pay, the precious metal escaping. There is a five-stamp mill, which is standing idle with the mine in consequence of litigation.

Mitchell.—The Mitchell mine, 1,200 feet long, is on a vein which runs northeast and southwest, and is 12 feet wide. The shaft is down 200 feet, and drifts have been run 100 feet on the vein. Some of the rock paid $60 to the ton, and thousands of tons have been worked. The mine is troubled by water, and common rumor in the neighborhood says the late explorations have not been in the pay chimney. There is a 20-stamp mill, which, as well as the mine, is standing idle.

Golden Gate.—The Golden Gate, two miles from Volcano, is 1,800 feet long on a vein three feet wide. A depth of 220 feet has been reached, and drifts have been run 350 feet on the vein, in pay chimneys all the way. About 2,800 tons have been worked, and rumor in the neighborhood says the yield has been $45,000, or $16 per ton. The mine is being opened further, but a 10-stamp mill belonging to the mine is standing idle.

Sirocco.—The Sirocco mine, a mile and a half west of Volcano, is 2,500 feet long, on a vein which is four feet wide, and runs north and south. A depth of 350 feet has been reached, and drifts have run 700 feet on the vein. The total number of tons worked has been 9,000, and the average yield of free gold in 1866 was $15. Near the surface some of the rock paid $80 per ton. The vein grows wider and the pay less per ton in proportion to the distance from the surface. Ten per cent. of the vein matter is sulphurets, which yield on an average $80 per ton. There is enough ore in sight to keep the 10-stamp mill busy for two years. Before 1867, the sulphurets were sold to Mr. Thoss; now they are saved.

Kelly.—The Kelly mine has one claim 1,200 feet long and another 1,500 feet long on two veins which intersect each other; one running north 30° east, and the other north 70° east. Both are intersected by a little vein which runs east and west, and though small is full of metal. A depth of 80 feet has been reached, and drifts have been run 150 feet. The rock averaged $14. A mill containing two stamps and two arrastras was erected in 1857, and ran four years, but has since been idle, and so has the mine.

SECTION VII.

EL DORADO COUNTY.

El Dorado county lies between the Cosumnes and the Middle fork of the American river, and extends from the eastern boundary of the State to near the Sacramento plain. It was in this county that Marshall made his discovery of the gold on the 19th January, 1848; and El Dorado was previous to 1853 called the Empire county, because it was for a time the most populous in the State, but it is now surpassed by many others.

In this county we observe various features not found in Mariposa, Tuolumne, Calaveras, or Amador.

Granite appears as the bed rock on the western border of the mining region.

No rich quartz veins are found in the granite at an elevation of 2,500 feet or more above the sea.

The lime belt, which is distinctly traceable across Tuolumne, Calaveras, and Amador, appears at Indian Diggings in El Dorado, and then seems to be lost.

A new lime belt appears very distinctly twelve miles west of the main belt. In this new belt is the beautiful Alabaster cave, near Centreville.

El Dorado has 25 ditches, with a total length of 821 miles, constructed at a cost of $1,500,000. Of these the principal are the South Fork, the Pilot Hill, and the Michigan Flat ditches.

TOWNS.—Placerville, the county seat, 50 miles from Sacramento, on the bank of Hangtown creek, has some hill diggings and quartz, and is the most prosperous town in the county. The principal mining towns are Georgetown, 14 miles north; Coloma, 10 miles northwest; Diamond Springs, three miles west; El Dorado, or Mud Springs, five miles west; Grizzly Flat, 20 miles southeast; Indian Diggings, 25 miles southeast; and Kelsey, seven miles north.

SHINGLE SPRINGS RAILROAD.—El Dorado county has a railroad 26 miles long, extending from Folsum to Shingle Springs. It was commenced with the intention of extending it across the Sierra, but the work was stopped when the road reached Shingle Springs in 1865, and there is no probability of its resumption soon. The terminus of the road is 11 miles from Placerville.

PLACERVILLE WAGON ROAD.—The Placerville road is the best wagon road across the Sierra Nevada. It cost $585,000, and as now travelled from Shingle Springs to Van Syckles, in Carson valley, is 82 miles long. The steepest grade is six degrees. The total length of the stretches that exceed five degrees is a mile and a half; there are five miles of five degrees, 10 miles of four degrees, and most of the road is under two degrees, with a very regular and easy ascent. In 1858 Sacramento and El Dorado counties each subscribed $25,000 to construct a wagon road across the mountains; but the road was not good enough for the purpose, and in 1860 the present road was commenced by private enterprise, and was finished in 1863. It was of vast service to the State and to Washoe during the silver excitement, and was for a time very profitable to the owners. Although other routes have lower passes and easier grades, no other can compete with this for the ordinary purposes of wagon travel, because this is on the shortest route between Sacramento and Virginia City, is an excellent road, and is kept in fine condition. In 1863 the total amount of tolls taken on the road was $190,000, and the expenses were $70,000; in 1866 the receipts were $65,000, and the expenses $50,000. The road is watered every evening along its whole length by water carts, which are stationed at intervals of three miles. This is found to be the cheapest method of keeping the road in good condition, for if it were left dry it would have deep dust, which would obstruct the wheels and blow away, leaving deep ruts. About one-fourth of the expense in keeping the road in order is required to keep the snow down. Last winter snow lay for nine miles on the road, and 10 span of horses were kept for the special purpose of breaking it down. There was a station in the middle of the snow belt, and whenever it began to snow a man started with a team and a sled in each direction to the end of the snow belt and then drove back; then took another team, and the horses were kept going as fast as they could. In this way the snow was packed down and the road was made hard and fit for travel. It would be useless to shovel the snow from the road, which would immediately drift full. The toll for a four-horse wagon from Shingle Springs to Van Syckles and back is $17 50, three-fourths being for the eastern trip. Most of the freight, however, has been carried in wagons drawn by more than four horses. The best teams have 10 mules and two wagons, the second wagon being smaller and fastened immediately to the first. An ordinary load for such a team is 20,000 pounds. The advantages of having two wagons instead of one are that one wagon, unless made in a most unwieldy manner, would not be strong enough to support the weight; that the two wagons do not cut up the road; that if there is a mud-hole, only a small part of the weight is in it at a time; that at any steep pitch in the road the wagons can be separated, and each hauled up separately; and that one teamster can as easily take care of two wagons as of one. The cost of the first wagon is about $600; of the second, $300; and of good mules, $300; making $3,900 as total cost, exclusive of harness. The tolls on a round trip from Shingle Springs to Van Syckles are $26 25; and the total necessary outlay on a trip $240. This is the most extensive toll road in the United States.

Miscellaneous Resources.—A considerable part of the marble used for tombstones in California is obtained from a marble quarry at Indian Diggings. Stealite, or soapstone, of very good quality is obtained from a quarry near Placerville, and numerous places in the county supply a chalk-like silicate of lime that is used in San Francisco for polishing metals, especially silver-ware. The county has 85,000 acres of enclosed land, 22,000 acres under cultivation, 1,164,000 grape-vines, 91,000 apple trees, 52,000 peach trees, saws 10,000,000 feet of lumber annually, has taxable property assessed at $3,500,000, and casts 5,000 votes. Agriculture has made more progress in this than in any other mountain county, perhaps because of its proximity to Nevada, which it supplies with fresh and canned fruit, with wine, and with many kinds of vegetables. The possession of the Placerville road across the mountains has done much to bring business to the county. The Alabaster cave in the northwestern corner, and Lake Tahoe at the northeastern, are both places of fashionable resort.

The Blue Channel.—There are several old channels in El Dorado county, and they appear to belong to two different systems of drainage and periods of existence. They may be distinguished as the blue and the gray, according to the color of the cement or gravel found in their beds. The blue is prior in time, and only one blue channel has been distinctly traced in the county. It runs from the northwest to the southeast, nearly with the course of the slates, and has been found at White Rock, Smith's Flat, and Tryagain tunnel. The channel is 220 feet wide, and 250 feet above the level of Weaver creek. The rim rock is never less than eight feet higher than the bottom of the channel. The cement is harder and more brittle, and contains more quartz, and quartz of a bluer color, and pebbles smaller and more uniform in size than the gray cement. This channel, with its well-defined banks and a deep covering of lava, formed a bed in which ran a subterranean stream of water that broke out in springs on the hillside, where the channel was cut through by Weber creek, and the quantity of water was sufficient to supply Placerville when it had 4,000 inhabitants. A tunnel company working in the basin of Hangtown creek cut a tunnel across this old channel, and the stream of water which had previously run down to Weber creek then ran out through this tunnel into Hangtown creek. The tunnel company sold the water to the Placerville Water Company, but the South Fork Canal Company, which had previously appropriated the water of Hangtown creek, brought suit for the water on the ground that Hangtown creek was the natural outlet for this water, and that they owned it by prior right. Professor Silliman was called as a witness by the defendants, and after examination he testified that the waters never had run into Hangtown creek, but that until the tunnel was cut their only escape was at the springs on the bank of Weber creek. The plaintiffs, after seeing the testimony, discontinued the suit. This is the only case known to us of a legal investigation into the character of an ancient auriferous channel in California.

Gray Channels.—The gray cement is in several channels, which rise 20 miles or further east of Brockliss's bridge, and runs westward across the blue channel and at a higher level in the divides between the present streams. The gray cement is from 20 to 50 feet deep, and is found on both sides of Hangtown creek, in high hills, which have been prospected along a length of 10 miles, and worked with profit in many places. The old channels were cut through by numerous ravines, which carried the gold down to the creek, and thus made the bed of that stream rich as it was in early days. The following are the principal claims on the Weber divide, south of Hangtown creek, commencing at Coon Hollow, on the north side, and going eastward.

Claims on Weber Divide.—Aldersen Brothers Hydraulic claim has been worked 12 years, has paid largely, and employs six men. The claim is 150 feet deep, and uses 200 inches of water.

The Phillips and Parker claim is 800 feet long by 300 wide, and 80 deep. It employs three men, and has paid well at times.

The Italian claim, 1,000 feet long, was worked for years by hydraulic process, but now the pay dirt is brought out through a tunnel.

The Weber claim is worked as a drift claim in the summer, when water is scarce, and as a hydraulic claim in the winter. It yields large pay.

The claim of the San Francisco Cement Gravel Company is 1,200 feet long, running, as do the other claims along here, to the middle of the Hill Learsago. A tunnel was run 800 feet into this claim, and was abandoned because the gravel was too hard to wash in a sluice. The company are now about to pipe away the face of the hill preparatory to opening and retimbering the old tunnel. It is the expectation of the company to erect a mill to crush the cement.

In the Buckeye claim the face of the hill is being piped away to make room for a cement mill.

On the Cox claim, Cox's pan is being tried for the reduction of cement. It is a cast-iron pan, six feet in diameter, and 18 inches deep, with four iron arms projecting on a level with the top of the pan from a central vertical axis, and from each arm project three strong wrought-iron fingers, reaching down to within an inch of the bottom of the pan. In the bottom are a number of holes, an eighth of an inch wide, and half an inch long, through which holes the pulverized matter escapes. The bottom is of white chilled iron. A charge of 1,200 pounds of cement is thrown in, a stream of five inches of water is turned on, and the arms are started, making 20 or 30 revolutions per minute. In seven minutes and a half all the pebbles and boulders are washed clean, and they are discharged through a gate into a sluice prepared for the special purpose of carrying them off. There is another sluice for washing the fine matter. Charging and discharging occupy two minutes and a half, but the discharging gate is to be enlarged, so that the discharge will not occupy more than a quarter of a minute, instead of two minutes, as at present. By this pan 40 tons can be worked in 12 hours, more than would be done by a 15-stamp mill, and the work is done in better style, because the pebbles and boulders which form from 50 to 75 per cent. of the cement are excluded from the sluice in which the gold is caught. The greater the quantity of base matter carried through the sluice, the greater the danger of the loss of gold. The power is supplied by a hurdy-gurdy wheel, which is eight feet in diameter, four inches in thickness, with buckets four inches deep, and nine inches apart. The power is nominally by 19 inches of water, but much is lost through leakage, and the proprietor of the pan asserts that he does not use more than 12 inches under a head of 260 feet. The wheel is made by bolting together two layers of two-inch plank, laid crosswise. The cost of the wheel was $100, and of the machinery, including pan, gearing, and all, less than $1,500. The cement in this claim appears to be nearly as hard as any found elsewhere.

In the Italian claim a tunnel is being run to be 800 feet long.

The Van Dusen claim has a tunnel 800 feet long, and is standing idle because of the hardness of the cement.

The Hardy Brothers have a hydraulic claim, which has been worked three years.

McConnell & Co. have the next claim, and work it by the hydraulic process.

Stewart and Hall have crushed their cement in an eight-stamp mill, which is now standing idle.

The Scott Brothers' claim is 1,000 feet long, was opened by a tunnel in 1854, and was abandoned because of the hardness of the cement. Work has now been resumed in the expectation of erecting a mill.

CLAIMS ON RESERVOIR HILL.—North of Placerville, on the north side of Reservoir Hill, commencing at the west, are the following claims, viz:

Hancock and Salter's hydraulic claim, drained by a tunnel, and open cut 1,500 feet long, has been worked by two men five years, employs 100 inches of water, and pays well.

The Friar claim has yielded $50,000, but after leaving the surface the miners found the cement so hard they could not wash it, and nothing was done on it for years. A San Francisco company is now at work, opening it by a tunnel, to be 1,000 feet long, and to be finished in two years.

The Slide claim is being opened by a tunnel, to be several hundred feet long. This claim never yielded much.

The Pioneer claim is worked by drifting, and has paid very high. It has been worked for 12 years.

The George Barlow claim is also worked by drifting, and has paid well at times.

The Live-oak claim is worked through a tunnel, and has yielded $50,000 or $60,000. Under this claim runs the blue channel.

The Roanoke claim has the repute of having been one of the richest claims on the channel, but nothing could be ascertained of its yield.

On the south side of Reservoir Hill are the following claims, viz:

The Trask claim is worked by the hydraulic process by a company of Chinamen with very little profit.

The Oldfield is a hydraulic claim.

The Wolverine was worked with much profit in early days, and then lay idle for a long time. Work has lately been resumed on it. It seems that there was a slide which threw the pay stratum out of its regular position in this claim.

The Ohio has a tunnel 800 feet long, employs five men, is paying well, and has been worked for 12 years.

Crusen & Co. have a claim on Wisconsin flat, and are trying to reach the Blue channel through a tunnel 1,200 feet long, from the end of which they are sinking a shaft to be 80 feet deep.

The Granite Company are running a tunnel to strike the Blue channel, and are in several hundred feet.

The Deep Channel Company has been at work seven or eight years. The dirt is hoisted through an incline by horse power, and pays $4 to the car load. Most of their cement is crushed in the 10-stamp custom mill of P. M. Taft.

The Blue Lead Company employ 10 or 15 men in their claim, and crush their cement, which yields about $8 per ton, in a 10-stamp mill, driven by 30 inches of water over a wheel 45 feet in diameter.

The Buchanan, Fremont, Henry Clay, and Hook and Ladder Companies, facing Smith's Flat on the east, have had some very rich claims.

Redd & Co. have a five-stamp custom mill, and crush cement for the Hook and Ladder Company.

SPANISH HILL CLAIMS.—On Spanish Hill, east of Placerville, are the following claims, viz:

Hoxie's claim, which is now exhausted. It paid from $10 to $16 per day to the hand for several years.

The Stogy Tunnel claim was equally rich, and is worked out.

The Bay State was also rich, and is not exhausted, but has been consolidated with the next claim, and is worked by hydraulic.

The Hook and Ladder claim has a crevice 175 feet, and a tunnel 600 feet long, running to the bottom of the crevice. The hill is to be washed down through the tunnel.

The Golden Gate and Duroc claims come next, and have been consolidated. Two auriferous quartz veins are found in the slate bed rock in these claims, and it is supposed that some of the gold came from the decomposition of the slate.

The Hoxie, Stogy, Bay State, Hook and Ladder, Golden Gate, and Duroc claims have yielded together not less than $200,000.

INDIAN DIGGINGS.—Indian Diggings, 25 miles southeastward from Placerville, is on the limestone belt, and is the furthest north of all the large mining camps on that belt. No solid bed rock is found here. It is supposed that pay gravel is found 200 feet from the surface, and to drain the diggings to that depth would require a tunnel a mile long. At Slug gulch a shaft was sunk down through what appeared to be solid limestone bed rock into a stratum of limestone boulders. A ditch of water was accidentally turned into this shaft, and the water ran there for several days without any accumulation of water in the shaft. No outlet was ever discovered. Brownsville, at the side of the Indian Diggings, may be considered part of the same place, and the two together have about 20 acres of deep diggings, which will not be exhausted for many years. Indian Diggings and Brownsville, unlike Columbia and Volcano, do not wash with a pipe in a dump box.

The Douglas hydraulic claim, the most notable claim at Brownsville, is 180 feet square, and was worked for 10 years previous to 1866. In 1856 and 1857 it yielded $55,000, and since the latter year has paid little over expenses. There has been no work of late for lack of drainage. An open cut has been started to drain the claim, so that it can be washed 20 feet deeper; 700 feet of the cut have been completed; there is a quarter of a mile still to be done, and several years may elapse before it is finished.

PLACERVILLE MINING REGULATIONS.—Each district in this county has its own mining regulations.

The mining regulations of the Placerville district, adopted March 21, 1863, provide that—

> Each claimant may hold 200 feet in length upon a ledge or lode with all its dips, spurs and angles, and 250 feet upon each side thereof.
>
> Each claim must be filed for record within five days of posting notice thereof, and the notice must distinctly specify the general direction of the claim, ledge, or lode, and the record made accordingly.

Each company shall be required to expend at least seven days' work upon the ledge or lode held by them for and in every month of the time said claim is held; otherwise the same may be considered as abandoned.

The number of quartz claims on record is 186.

The following are copies of notices entered in the record book:

Notice is hereby given that we the undersigned claim 1,000 feet on this ledge, commencing at this notice and running in a northerly direction to a stake and pile of stones, and that we intend to hold and work the same according to the laws of the Placerville mining district. Said claim is situated in H. S. Hulburd's ranch, in Placerville. May 23, 1867.

[Signatures.]

Notice is hereby given that we the undersigned claim 1,500 feet each way from this notice, on any and all quartz lodes discovered in sinking this shaft. July 18, 1866.

[Signatures.]

MUD SPRINGS MINING REGULATIONS.—The following are the principal provisions of the mining regulations of the El Dorado or Mud Springs district, adopted April 7, 1863:

No person shall be allowed to hold more than 300 feet by location on the same ledge, but can hold 600 feet in width for the purpose of prospecting and defining his lead or ledge. The discoverer of a ledge is entitled to an extra claim.

A notice upon a claim to be valid must be written with ink, and placed upon a board, stake, or tree in as conspicuous a place as possible, and upon, or as near the ledge as can be. Such notice must state the number of feet claimed, describing as accurately as possible the boundaries thereof, containing all the names of the claimants with the date truly affixed; a true copy of which must be recorded by the district recorder within 20 days from the date of such notice, or such claim shall be considered forfeited.

Notice upon a claim holds the same for 20 days only. Recording the notice of a claim holds the same for 90 days only, before the expiration of which time labor to the amount of $2 50 for each 300 feet in the claim must be expended upon the claim by the company, which will hold the same for 15 months from the date of record. Non-compliance with the provisions of this article by any company will be construed as an abandonment by them of their claim.

In case of dispute between parties claiming the same ledge or lead, each of the contending parties may choose an arbitrator, and the two may choose a third person, who shall be disinterested. The three shall constitute a board of arbitrators, whose decision shall be final, unless notice of an appeal be given within ten days of the rendition of the decision.

There is no provision requiring a description of boundaries.

The number of claims on record is 40. The following is a copy of one of the notices recorded:

DRY CREEK, *April* 1, 1863.

Know all men by these presents that we the undersigned claim 45 claims on this lode, 300 feet each, making in all 13,500 feet, and intend prospecting the said claims for coal, copper, silver, gold, or any other minerals it may contain, running in a northerly direction 13,000 feet and southerly 500 feet, with all its dips, angles, and spurs.

[Forty-five signatures.]

GEORGETOWN MINING REGULATIONS.—The following are a portion of the quartz regulations of the Georgetown mining district, adopted December 10, 1866:

The size of claims to each person locating shall be 200 feet of or on any quartz lode or ledge, including all dips, spurs, angles, and all surface ground and minerals which may be contained within the space of 150 feet on each side of said ledge or vein located; but no company's claim shall exceed 3,000 feet in length on any one vein or ledge.

The discoverer of a vein or lode of minerals shall be entitled to one claim for his discovery.

All notices of claims located, whether individual or company, shall describe the locality of said mine, the number of feet claimed, the point where measurement commences, and name the lode or company locating.

Said notice shall be posted on the lode, and shall hold the claim for 10 days from the date thereof without record, but no claim shall be held valid without record after the expiration of said time unless labor is being done on said claim.

All notices of quartz mining claims are required to be recorded unless labor is being done on the claim, by a recorder elected by the miners of Georgetown quartz mining district.

Said district recorder shall keep a book, record all claims, copy the notice, and give the names of the members of each company.

It shall be the duty of the recorder to go upon the ground and define the claim, measuring and staking the same, and he shall receive for such service the sum of 50 cents for each name, and if not required to perform such service, to receive 25 cents only.

Any person or corporated company locating a mining claim within this district shall be required to have expended in actual labor upon each and every claim not exceeding 1,200 feet, and a proportionate amount for larger or smaller claims, the sum of $50, within 60 days from the date of the record, and $150 within six months from the date of record, and a like amount for every additional six months until the sum of $500 shall have been expended.

Whenever the sum of $500 shall have been expended in prospecting or development of the mine, whether by sinking shafts, running tunnels, cuts, or drifts, whether on the ledge or in the direction thereof, designed practically to develop the claim, then and thereafter for the term of two years said claim shall be held by the parties peforming the labor or expending the said amount; but no labor being performed for the period of two years, the said claim shall be considered abandoned and subject to relocation.

Reed.—The Reed mine, 2,000 feet long, is three miles south of Placerville, has a greenstone hanging wall, a slate foot wall, and a vein 18 feet wide. The quartz, as found by a shaft running down 80 feet prospects well, and a 10-stamp mill is going up.

Pacific.—The Pacific mine, 1,800 feet long, is on the same lode, and is within the limits of Placerville. The mine was opened in 1852, and was worked till 1862, when it caved in, and then it lay idle four years. Lately a Boston company has purchased it and opened the main shaft to a depth of 320 feet, and found some good quartz, but not enough to commence work upon. The quartz is a ribbon rock, tinged in places with a green color. The total yield of the mine is reported to have been $500,000, and the annual average profit for seven or eight years $30,000. The new shaft was started 120 feet northeastward of the working vein, and in going down 300 feet four veins were intersected, each about six feet thick, all containing similar quartz and all widening out as they go down. The two middle veins thus far reached are mixed with a large proportion of talcose slate, and appear to be barren. The westernmost of the four veins has produced all the gold of the Pacific mine in a depth of 200 feet, in a pay chimney 200 feet long. The chimney was nearly vertical, but dipped slightly to the north. A 20-stamp mill, erected in 1853, is standing idle.

Harmon.—The Harmon mine, 1,400 feet long, just north of Placerville, is on a vein which is 100 yards west of the Pacific lode, and is 30 feet wide in places, though the average is not over four or five. The vein stone is a white quartz with seams of black slate, and a considerable proportion of sulphurets of iron and lead. It was worked with arrastras and paid high; and then a 15-stamp mill was erected, but that has not been profitable and is now idle. The reputed cause of the trouble is the difficulty of reducing the undecomposed sulphurets found below the water-line.

Shepard.—The Shepard mine is 1,200 feet long, on a vein two feet wide, near Placerville. The claim was opened at the end of 1866, and yielded some rich pockets of beautiful foliated gold. The specimens extracted were worth $5,000. The mill rock from its appearance must have contained at least $30 per ton. The vein matter was much of it an ochrous earth, intersected with seams of quartz. The rock was worked through a crusher and two arrastras driven by steam. Much of the vein has been opened by open cut to a depth of fifteen feet.

Cleopatra.—The Cleopatra, 1,200 feet long, on the same vein, is to be opened to a depth of 100 feet, and then if the rock prospects well a mill is to be erected with a capacity to crush 20 tons per day; the contractor to receive half half the mine for opening it and erecting the mill.

White and Burdick.—White and Burdick own two claims, one of 2,000, the other of 1,800 feet, on the same vein. The claim of 1,800 feet has been opened to a depth of 75 feet, but the mine caved in several years since and is not well reopened yet. Miners have been working at it since last year. There is a 10-stamp mill, which was built in 1861.

Perseveré.—The Persevere mine, 4,200 feet, at Poverty Point, near Placerville, is on a vein five feet wide. A depth of 155 feet has been reached and a drift has been run 45 feet on the vein. No mill has been erected yet.

White.—The White mine, 2,000 feet long, near Placerville, has a 15-stamp mill, which is idle. A new shaft is now being sunk. The rock is rich in sulphurets.

Manning.—The Manning mine, five miles eastward from Placerville, has a vein two feet wide, a shaft 180 feet deep, and a six-stamp mill. No work is being done.

Elle Ellen.—The Elle Ellen, 2,000 feet long, is half a mile from the Manning, on a vein which runs northwest and southeast, is nine feet wide, and dips to the east at an angle of 80°. The hanging wall is hard blue slate, and the foot wall brown slate. There is a tunnel 100 feet long run on the vein. There is no mill.

Eppley.—The Eppley mine, 1,200 feet long, two miles and a half south of Placerville, has been opened to a depth of 85 feet, and 30 tons of rock sent to mill have yielded $1,500, or $50 per ton. The mine is to be opened further, and so soon as enough good quartz to pay for a mill is in sight, one will be built.

Davidson.—The Davidson mine, a mile and a quarter northwest of Placerville, has a tunnel 350 feet long and a shaft 160 feet deep. The quartz prospects well, but none has been worked as yet. The New York and El Dorado mill, of 20 stamps, has been purchased to be erected on this mine.

Montezuma.—The Montezuma Quartz Mining Company, an English association, own claims on four veins seven miles south of El Dorado, and are working two of the claims. That on the Montezuma vein is 1,900 feet long; has been worked since 1851, and has yielded $150,000. The lode runs north and south, is three feet wide, has slate walls and ribbon quartz, which averages $10 per ton. There is a black clay slate gouge on the hanging wall. A depth of 180 feet has been reached and drifts have been run 180 feet on the vein. The McDowell vein is seven feet wide, three-quarters of a mile east of the Montezuma and parallel with it. A depth of 25 feet has been reached. There is a 20-stamp mill, made to run either by steam or water. The Montezuma Company have invested $100,000 in the property, and it is said they are the only English company mining for gold now in California.

New York and El Dorado mill.—The New York and El Dorado mill was erected at a cost of $20,000, five miles south of El Dorado, by a New York company under representations that they possessed a splendid mine; but they found nothing, and the mill has been sold for $2,500 to be moved to Davidson's mine, a mile and a quarter northwest of Placerville.

Hermitage.—The Hermitage mine, six miles south of El Dorado, at Sugar Loaf, is on a pocket vein and has paid irregularly, yielding $100,000 in all. A mill was erected in 1852 and taken down, and a second mill of 20 stamps was erected in 1866, at a cost of $17,500, by a Boston company, which paid $38,000 for the mine. The vein is 10 feet wide, and a depth of 175 feet has been reached. A tunnel is being run to intersect the shaft at a distance of 170 feet. It is said that there is a large quantity of pay rock in sight suitable for milling, but most of the gold heretofore obtained has been taken out in a hand mortar. The mine was discovered by placer miners, who followed up a rich streak of gold in gravel till it stopped at this quartz vein.

Union.—The Union lode runs north 10° east, dips east at an angle of 80°, and is from 3 to 12 feet thick in slate walls, which, according to Professor Silliman, who made a report on the mine, is striated in lines dipping to the southeast. The quartz is soft, fissile, and ferruginous. The stope north of the shaft yielded 15,000 tons, from which, according to the books kept at the mill, $450,000 were obtained. A large part of the claim is unexplored, and its value is merely conjectural beyond the pay chimney at the shaft. The Cosumnes lode is 120 feet west of the Union, and has the same dip and general course, although there are some bends in it. It is three or four feet thick, and the quartz bears a strong resemblance to that of the Princeton mine. The walls are of coal black shale, and there is a black putty gouge on the eastern wall. This vein has a shaft 120 feet deep. Some of the croppings were very rich and yielded most of $150,000 taken out by the mill from rock that did not come from the Union mine.

WILDER.—The Wilder quartz mine, a mile and a half west of El Dorado, is on a vein three feet wide, containing quartz that yields $9 per ton. An eight-stamp water-mill has been running two years.

POCAHONTAS.—The Pocahontas mine, two miles south of El Dorado, has a vein four feet wide and a pay chimney a 100 feet long, averaging $15 per ton. There is a 10-stamp mill which has been at work one year, and has paid for itself and for all the work done in opening the mine.

UNION CHURCH.—The Union Church Gold Mining Company have claims on three veins, three miles southeast of El Dorado. The Union claim has been worked since 1852, has been stoped to a depth of 160 feet, and has yielded a large amount of gold. There is water in this claim now, and it is being taken out preparatory to sinking. The Cosumnes claim is now being worked, and the rock yields $10 or $12 per ton.

GRAY.—The Gray mine, three miles east of Shingle Springs, is a rich deposit of decomposed quartz in a vein five feet wide. On one occasion specimens worth $10,000 were taken out in one day. A depth of 60 feet has been reached. There is a 10-stamp mill, built in 1865.

BRYANT.—The Bryant mine, two miles south of El Dorado, yielded $20,000 in one pocket, which was emptied in three days in 1857. Considerable quantities of quartz, sent to a mill four miles off, paid well. The mill ran several years, then was abandoned, and now a 20-stamp steam mill is to be built. A depth of 150 feet has been reached, and drifts have been run 600 feet on the vein.

BEARD.—The Beard mine, two miles south of El Dorado, has yielded $250,000, proving very profitable at times. The gold was deposited chiefly in numerous little chimneys or streaks, which the miners followed. There was a 10-stamp mill in 1860, but it was moved away to the State of Nevada.

The Jamison mine, at Aurum City, has been worked about a year with an arrastra.

INDEPENDENCE.—The Independence mine, 1,200 feet long, at Brownsville, is on a vein which runs east and west, is three and a half feet thick, and has granite for a hanging wall and "blue trap," as the miners call it, for a foot wall. A tunnel has been run 400 feet on the vein, in pay all the way; 250 tons have been worked, and the yield has been $30 per ton, in the Tullock eight-stamp mill, rented for the purpose. The Independence mill is now being built and is to have 10 stamps. The quartz contains a large proportion of rich sulphurets.

STILLWAGON.—The Stillwagon mine, also at Brownsville, is on a vein similar to that of the Independence. There is a five-stamp mill, which, with the labor of six men, took out $4,600 in May, 1867. The average yield is $25 per ton.

There are no other quartz mines regularly at work at Brownsville.

SLIGER.—The Sliger mine, 400 feet long, is four miles southwest of Georgetown, on a vein four feet wide, between granite on the west and slate on the east. Five thousand dollars were taken out of a pocket near the surface. The mine is now being opened.

GREENWOOD.—The Greenwood mine, five miles southwest of Georgetown, has been opened by a cross-tunnel 400 feet long. A 15-stamp mill has just been erected, but work is not yet commenced at crushing.

Taylor.—The Taylor mine, 3,000 feet long, is two and a half miles south of Georgetown, on a lode that runs north-northwest and south-southeast, and is two feet wide at the surface, and six feet at a depth of 100 feet. A depth of 107 feet has been reached by an incline, and drifts have been run 41 feet. The vein is filled with seams of slate, but the quartz shows free gold in all parts of the mine. There is a black putty gouge two feet thick in places. The west wall is bastard granite, the east slate. There is no mill.

Rosecrans.—The Rosecrans mine, 900 feet long, adjoins the Taylor on the south. The shaft is down 40 feet; and 60 tons crushed at a custom mill yielded $12 on an average. The vein has been uncovered for 280 feet along the surface, and it shows gold all the way.

Blue Lead.—The Blue Lead, three miles south of Georgetown, has been opened by a San Francisco company to a depth of 250 feet and to considerable length. The quartz is mixed with blue slate and shows some fine specimens, but has not paid. A very fine 20-stamp mill has been erected, and about $250,000 have been invested permanently in the mine. Work has ceased.

Collins.—In the Collins mine, one mile south of Georgetown, the vein has been reached 170 feet below the surface by a tunnel 250 feet long. The vein is eight feet wide, and the rock in sight will yield $15 per ton.

Alpine.—The Alpine, on the same vein, is four feet wide, is working with an arrastra, and obtains $12 per ton. The quartz is extracted through a tunnel 150 feet long. The Mount Hope Company, of San Francisco, own a claim of 3,000 feet adjoining the Alpine. The vein is six feet wide, but is split up considerably. The shaft is 61 feet deep.

The Philadelphia Slide Company, of San Francisco, have 3,000 feet on a vein half a mile south of Georgetown, and have levied an assessment for the purpose of erecting hoisting works.

The Clipper mine, two and a half miles northeast of Georgetown, is 5,000 feet long, on a vein two and a half feet wide, running north and south between a granite foot wall and a slate hanging wall. The deepest workings are 80 feet from the surface. About 700 tons of quartz have been crushed, and the yield was $15 per ton. There is a stamp mill which is not running.

Woodside.—The Woodside mine in Georgetown is 1,200 feet long, on a vertical vein, which is two feet wide and runs northeast and southwest between slate walls. A shaft has been sunk 110 feet, and drifts have been run 40 feet on the vein. The average yield has been $30 per ton for mill rock, exclusive of specimens worth $12,000. On one occasion a mass of rock was found so tied together with seams of gold running through it that a cold chisel had to be used to cut it. The pay chimney dips to the northeast. There is a five-stamp mill driven by water power, but it has had little to do lately, the mine having been filled with water last winter. The lode is rich in sulphurets, and has peculiar sheets of sulphurets about an eighth of an inch thick, with transverse crystals running from side to side. Mr. Woodside is the inventor of a concentrator which he uses in his mill. It consists of a sheet of India-rubber cloth, 22 inches wide and about eight feet long, sewed together at the ends and stretched over two wooden rollers four inches in diameter and three feet apart. The rollers are placed on a frame horizontally, one three inches higher than the other. The rollers turn so that the cloth makes three complete revolutions in a minute. A water pipe perforated with little holes passes above the cloth near the upper roller and discharges a number of little streams, which wash away the light sands and leave the heavy sulphurets to be carried up over the upper roller, and after passing that they drop down into a box beneath. The concentrator has been used in this mill for a year to the satisfaction of the inventor, but nobody else has adopted it. The mine was discovered by the gentleman whose name it bears. He picked up a piece of auriferous quartz in a little ravine, and then sought for croppings, and when he prized up a piece of rusty rock that peeped out of the ground, he found the under side of it speckled with gold. He immediately commenced work, and the mine paid its way from the surface to its present depth.

James's Mill.—James's custom mill, with five stamps, eight miles south of Georgetown, is standing idle.

Eureka.—The Eureka mine, on the same vein, north of the Woodside, is 900 feet long, and has been opened to a depth of 130 feet. There is a steam hoisting establishment, but no mill, on the mine.

Georgia Slide.—Georgia Slide, one mile north of Georgetown, is a mining camp on a hillside, where, under rich placers, are found a multitude of small seams of decomposed auriferous quartz. Three companies are sluicing; one is working with a seven-stamp mill and another is putting up an arrastra. The hillside has yielded an immense quantity of gold.

Mosquito.—The Mosquito mine, eight miles east of Kelsey's, is in granite. A mill built in 1866 had its roof broken in by the weight of snow last winter.

Plymouth.—The Plymouth mine, a mile and a half west of Kelsey's, is on a vein very irregular in width, but averaging seven feet. The rock averages $18 per ton; but 15 tons, selected carefully from 700 tons, yielded $8,000. The quartz contains eight per cent. of sulphurets.

Gopher.—The Gopher mine, a mile west of Kelsey's, has three veins, with an aggregate thickness of eighteen feet. Most of the pay is in the western vein. The rock is a ribbon quartz, rich in sulphurets, and there are slate walls on both sides. A depth of 100 feet was reached, but the old works have caved in, and the mine has not been reopened. In 1858 the mine yielded $15,600. There was a mill, which has been moved to Washoe.

Last Chance.—The Last Chance mine, 800 feet long, is opposite Coloma, on the north side of the south fork of the American river. The vein runs north and south, dips to the west at an angle of 50°, and varies in width from 2 to 12 feet. The eastern wall is greenstone, and the western granite; but on the western side, for a depth of 400 feet on the hillside, there was no wall—only a bed of gravel, which has been sluiced away, leaving the quartz exposed, so that an immense quantity of rock can be obtained without using either shaft or tunnel. Two men can take out 20 tons in a day ready for the mill. Both free gold and sulphurets are abundant, but some selection is necessary. The total yield, as reported by one of the owners, has been $60,000, though rumor among outsiders says it has been $200,000. One lot of 500 tons of quartz paid only $2 per ton; then 30 tons yielded $250 per ton; and five tons of the best yielded $40,000. There is a 10-stamp mill, with a Joinville turbine, driven by 60 inches of water under 70 feet of head. Amalgamation is effected in the mortar and on copper plates; the tailings are concentrated on blankets, and the blanket washings are worked in an arrastra. A railway track, 2,100 feet long, is being laid from the mine to the mill, and when it is finished the proprietors expect that their entire expenses will not exceed $3 per ton. The owners of this mine are Danes, and it is generally known as the Danes' mine, though that name belongs to the next claim.

The Danes' mine, 2,200 feet, is on the same vein as the last, but has produced nothing and is unopened.

Reward.—The Reward is 1,400 feet long, one mile southwest from Uniontown. The rock prospects well, and the walls are slate on the west and granite on the east. A tunnel is being run in to strike the vein 135 feet from the surface.

SECTION VIII.

PLACER COUNTY.

Placer is a large county, and the only one that reaches from the Sacramento river to the eastern boundary of the State. It extends with the meridian from the middle fork of the American to Bear river.

Its chief mineral wealth is in the Blue lead, which crosses the county at an elevation of 3,000 feet above the sea, and is worked at Dutch Flat, Gold Run, Indiana Hill, Iowa Hill, Picayune Divide, Yankee Jim, and Forest Hill. Ancient gravel deposits appear also at Todd's Valley, Paradise, Bath, Michigan Bluff, Damascus, and Monona Flat.

The surface placers of the county produce very little now. The county, in proportion to the richness of placers, has, so far as known, the poorest quartz mines in the State. The Green Emigrant mine, lately opened, has produced some rich specimens, but the owners keep the amount secret, and they have no mill; and no other quartz mine in Placer has paid any considerable profit.

Miscellaneous Resources.—Nearly all of the Central Pacific railroad in California is in this county, and the people have derived considerable profit from it in one way or another. The county is also crossed by the unfinished road from Lincoln to Marysville.

The county is supplied with water for mining and irrigation by the Bear river, South Yuba, Dutch Flat, Michigan Bluff, and numerous smaller ditches. Their total number is 29; their length, 699 miles; their cost, $2,000,000.

The western and lower part of the county has much good farming land. There are 60,000 acres of land enclosed, 20,000 cultivated, including 3,000 in wheat, 310,000 grape vines, 30,000 apple trees, as many peach trees, 5,000 head of neat cattle, 20,000 sheep, 20 saw-mills, which turn out 10,000,000 feet of lumber annually, 14 toll-roads 131 miles long, made at a cost of $350,000, and $3,000,000 of taxable property.

The Forest Hill Divide.—The Forest Hill ridge, on the southern line of the county, at an elevation varying from 3,000 to 3,500 feet above the sea, has the rich mining camps of Todd's Valley, Forest Hill, Bath, and Michigan Bluff, on the south side of the ridge, and Yankee Jim and Damascus on the north. Todd's Valley, Michigan Bluff, and Yankee Jim had chiefly hydraulic claims, and are now nearly worked out. Bath has cement claims, and is more prosperous than ever, besides being a pretty town prettily situated. Forest Hill has declined much, but it has a large body of rich ground, and will probably see a return of prosperity.

Yankee Jim was a long time the chief trading point for this divide, but now it has lost its trade, as well as exhausted its placers.

The gold at Damascus has the peculiarity that a tin-cup-full of it will weigh 20 per cent. more than an equal measure of the common dust.

Forest Hill.—Forest Hill, which has been the most productive cement tunnel-mining district in the State, is situated 22 miles eastward from Auburn, at an elevation of 3,400 feet high, on the summit of the divide between the middle fork of the American and Shirt Tail cañon. The town is 2,500 feet above the level of the middle fork, and about a mile distant. The scenery along the cañon is grand. Five miles further up the divide is Michigan Bluff, and the Auburn stage runs through to that point; but there is no other stage running to Forest Hill. The cañons north and south are too deep and steep for much wagon travel. The Forest Hill ridge appears to be composed of auriferous gravel covered by volcanic sand, but the Forest Hill diggings are in the Blue lead which crosses the ridge from north to south. These diggings are 500 feet below the summit and 2,000 feet above the level of the river.

The Blue Lead at Forest Hill.—In the Blue lead the lowest stratum resting on the slate-bed rock is the blue cement proper, from 5 to 20 feet in thickness; above that is a red gravel, 100 feet thick; and over that is volcanic sand, which is covered in places by a stratum of trachytic boulders and soil. The blue cement is harder than the red gravel. The boulders and pebbles in the red gravel are all of quartz; those in the blue are quartz, slate, and greenstone. The red gravel has smooth gold in coarse pieces, most of them weighing two pennyweights or more, and some as much as seven ounces, and 900 fine. The gold in the blue cement is fine, flaky, 860 fine, the largest piece not worth more than 75 cents. The slate-bed rock is soft, and the gold is found in its seams to a depth of four feet. This gold is coarse, and is black externally, so that a person not familiar with it would not suspect its value on looking at it. The Blue lead contains large quantities of sulphurets, which are rich in gold.

The claims at Forest Hill are 50 feet along the side of the hill to the person, and extend in to the middle of the hill, a distance varying from 2,000 to 5,000 feet.

CARELESS WORKING.—Instead of working the claim regularly from end to end, the companies generally sought to get out the richest and the softest dirt; and they changed about from place to place nearly every week, so they had not much room to work. They could not afford to lay tracks down to haul out their gravel; many of their drifts could be used for only a brief period, and the top caved down in the spots which they had worked, enclosing good ground, the position of which cannot now be ascertained without much expense. The New Jersey claim was the most notable exception to this mode of procedure in the district.

FUTURE OF FOREST HILL.—J. W. Reamer, superintendent of that company, is of the opinion that Forest Hill might be made more productive than ever by consolidating the claims and working them systematically on a large scale. There ought to be a large tunnel for each, half a mile, 60 feet below the level of the present tunnels, so as to be certain of having drainage for the deepest gravel that could be found. These tunnels should be made for the purpose of using mules to haul out the gravel and haul in the cars. There should be large mills to crush the cement; the sulphurets should be saved carefully, and all the pay dirt should be removed so that a place should not be left until everything of value had been extracted.

In 1859 Forest Hill shipped $100,000 of dust monthly; now $25,000 or $30,000. Forest Hill is one of very few places where the pay dirt swells; but a tunnel cut in the blue cement, as well as one cut in the slate, will soon close up here by the swelling of the earth if it is not trimmed frequently.

THE PRINCIPAL CLAIMS.—The principal claims at Forest Hill and in the vicinity have been the following:

The Dardanelles has yielded $2,000,000; the Jenny Lind has yielded $1,100,000; the New Jersey has yielded $850,000; the Independence has yielded $450,000; the Deidesheimer has yielded $650,000; the Fast and Nortwood, the Rough and Ready, and the Gore, have each yielded $250,000; the Alabama has yielded $150,000.

It is said that the claims within rifle-shot of the express office have produced not less than $10,000,000. No other placer district in the State can show a yield equal to this, and yet it is certain that a large proportion of the gold has been lost. The gravel or cement extracted was hard, and a considerable proportion of it was carried away by the water in lumps rich in gold. Mr. Reamer says that if he could have another claim like the New Jersey to work, with a cement mill, and with sufficient means to cut his tunnels and drifts in the most economical manner, he could obtain $2,000,000 instead of $850,000 from the same quantity of dirt.

CLAIMS AT TODD'S VALLEY.—The Golden Calf claim, near Todd's valley, below Forest Hill, has 1,000 feet front on the hillside and a tunnel 1,800 feet long. It has never been worked systematically, and has not paid.

The Big Springs claim, with 975 feet of frontage, is being opened, and meantime a 10-stamp cement mill built to work it is standing idle.

DARDANELLS.—The Dardanells Company have 1,000 feet front, commenced work in 1853, and have been at work ever since—at first drifting and now piping. They have taken out $2,000,000 from the blue gravel, which is soft there. They have worked out 400 feet along the front, have run tunnels 1,600 or 1,800 feet, and have drifted out much ground. They can hydraulic away about 300 feet along the face of their claim, but beyond that the hill is too deep to pay for piping. At one time the company employed 60 or 70 men, now they have only four or five, but these with pipes do more than twelve times the number did drifting. The company own a ditch which is 10 miles long, cost $15,000, and supplies 300 inches of water from the 1st December till the 1st of June.

ORO, GREEN SPRING AND UNCLE SAM.—The Oro, 1,000 feet, has yielded $35,000, but is now in litigation, is not doing anything of note, and never was worked with much system. There is a 20-stamp cement mill on it, now idle.

The Green Spring, 750 feet long, has a bed-rock tunnel reaching to the pay dirt, none of which has yet been worked. The tunnel was commenced in 1854, by poor men, who worked a portion of their time in surface placers or as hired laborers to get the means for continuing work on this claim. It is probable that the front of the hill will be piped away so as to expose the cement, which can then be obtained, at little cost, for crushing.

The Uncle Sam Company have 100 feet and have done very little. Three men are engaged in tunnelling and washing.

HOPE AND ROCKLAND.—The Hope claim is 500 feet long on the hillside, has a tunnel 2,000 feet long in bed rock, has a 20-stamp mill, has yielded $20,000, and has cost $100,000. The mine is now being opened with the expectation of crushing. The mill was kept running six weeks and paid well.

The Rockland, Baltimore and Boston claim is 2,600 feet long; has a tunnel 2,300 feet long; has cost $100,000, and has yielded no return as yet. The tunnel was commenced in 1854, and it has not yet reached the channel.

FAST AND NORTWOOD.—The Fast and Nortwood claim, 400 feet long, has been worked through the Baltimore tunnel, and has yielded $250.000. The company run their dirt in drifts on four different levels, and must load it four different times before they get it to the surface. The claim, in consequence of this mode of working, has not been profitable for several years, but the cement is rich, paying $5 to the carload, or about $7 50 per ton, and there is a large quantity of it. There is a 10-stamp mill to crush the cement.

SNYDER.—The Snyder claim, 200 feet long, has yielded $250,000. This was the pioneer claim of the district, the blue lead having been discovered here in December, 1852, by Mr. Snyder, on a hillside where a slide occurred, exposing the rich gravel to view. A little basin 40 feet in diameter at the slide yielded $40,000. When work was stopped, three years ago, there was a tunnel 1,800 feet long, but as the rock swells very rapidly it is now entirely closed up. There was a stretch of 400 feet in the tunnel where the rock swelled so rapidly that as much rock as would fill the tunnel had to be taken out in each period of eight months. The entire yield was obtained from the red gravel, and that was worked without system.

INDEPENDENCE.—The Independence, now united with the adjoining New Jersey claim, had a tunnel 3,500 feet long, and produced $450,000 before the consolidation. It was worked without system. One spot about 20 feet square yielded $10,000.

NEW JERSEY.—The New Jersey claim is 650 feet front by 4,000 feet deep, under the lower part of the town of Forest Hill. Work was commenced in August, 1853, on the tunnel, and six years and a half of hard work passed with an expenditure of $60,000 before any return was obtained. When the tunnel was in 1,800 feet, an incline was run upwards to the red gravel, which was found to be rich, and the $850,000 were taken from an area 500 feet long by 400 feet wide. The extraction of gravel was continued till April, 1867, when drifts were commenced to open new ground. The tunnel was started in 1853, with the confident expectation of reaching pay in a year; but as the work advanced more slowly and cost far more, the company had to run in debt, and when they reached the pay their debts amounted to $30,000 or more, and some of them had been outstanding for more than four years. The creditors numbered 8 or 10, mostly merchants, who knew nothing of the New Jersey Company save that they appeared to be hard-working, sober, honest men, and were trying to develop a claim supposed to be valuable. There was no long personal acquaintance and no security. The debts bore three per cent. interest per month. The most dangerous period for the company was after they began to wash. A dishonest creditor might then, perhaps, have taken the claim, or at least have caused much expense by an attachment suit; so the fact of the finding of good pay was kept as secret as possible until the $30,000 had been taken out, and then all were paid off at once. This system of giving credits was general in the mines 15 years ago, when the profits charged were very high, when large interest was allowed, when many extensive enterprises were undertaken, and when a large number of these enterprises met with magnificent success, of which the New Jersey claim is a bright example.

Seven channels have been found in this claim running with the slates about northwest and southeast, all parallel to one another, about 25 feet apart, 60 feet wide, with ridges of rock seven feet high between them. The dip from each side of the divide seems to be towards the middle of the hill. There is no water for washing from the middle of July till the middle of November, and meantime the dirt extracted is thrown into a pit large enough to hold 8,000 tons, where water is thrown on it occasionally so as to soften the cement and also to attach the mass together and prevent it from sliding down hill when the rains come. In busy times the New Jersey Company employs 60 or 70 men, the annual expenses are $60,000 or $70,000, and the profit one-half of the yield.

The dirt is hauled out in cars four feet and nine inches long, 28 inches wide, and 15 inches deep. The weight of an ordinary car-load is 1,600 pounds. A steady stream of water runs out from the tunnel and is caught in wooden reservoirs, 20 feet square and eight feet deep, to be used for washing. The sluice is half a mile long, and the grade is in one part 18 inches and in another 23 inches to 12 feet. The steepness of the cañon renders it necessary to have a steep sluice. Slat riffles made of five strips of board an inch thick, two inches wide and six feet long, with strips of the same thickness set between at the ends and the middle and bolted through, are used. The top of each strip is shod with a strip of iron an inch and a half wide and a quarter of an inch thick, screwed on and countersunk.

JENNY LIND.—The Jenny Lind, 450 feet on the hillside, had a tunnel 2,800 feet long, which is now probably closed up, at least in places, since no work has been done for three years. The yield, almost exclusively from the red gravel, was $1,100,000, and there is a large amount of ground still unworked. In this claim were found many rich quartz boulders. The yield of $1,100,000 was obtained by the company from the first washing, leaving to others who rewashed the dirt a very large sum in addition.

GORE, MAINE, AND ROUGH.—The Gore claim, 100 feet wide in front on the hillside and twice as wide further back, took out $250,000 from a tunnel 1,200 feet long. No work has been done for four or five years. Rich quartz boulders were found in this claim also.

The Maine claim, 200 feet front, had a tunnel 1,200 feet long, and took out $250,000. No work has been done for four years.

The Rough and Ready has 1,200 feet front, had a tunnel 1,200 feet long, took out $250,000, and has done no work for three years.

DEIDESHEIMER AND OTHERS.—The Deidesheimer has 400 feet front, had a tunnel 1,800 feet long, took out $650,000, obtained much from quartz boulders, and has done nothing for three years.

The India Rubber has 250 feet front, had a tunnel 1,200 feet long, produced $50,000, and has done no work for three years.

The Alabama has a frontage of 300 feet, had a tunnel 1,200 feet long, took $150,000, and has done nothing in the last three years.

The Eagle has 200 feet front, had a tunnel 800 feet long, expended $40,000 or $50,000, and took out $15,000.

The Moss has 900 feet front and a tunnel 1,000 feet long, but found no gravel, though it is generally supposed that there is rich gravel in the claim. Quartz was found in the tunnel, and a 10-stamp mill was erected to work it; but it did not pay. This is the last claim to the eastward in the Forest Hill district.

An unrepealed provision in the miners' regulations of the district requires one day's work every month from December till June to hold the claims, but so much work has been done that nobody seems to think of forfeiture under the letter of the regulations.

MICHIGAN BLUFF.—Michigan Bluff, seven miles from Forest Hill, on the same divide, and 29 miles from Auburn, saw its best days between 1853 and 1858, when it shipped $100,000 per month; and now it does not ship more than $25,000. The claims were worked first by drifting and then by the hydraulic process, and for a time this was one of the principal hydraulic camps in the State.

The pay stratum is remarkable on account of containing ninety-five per cent. of quartz boulders, pebbles, and sand, and not more than five per cent. of clay. Some of the boulders weigh twenty tons, and half the weight of the boulders is in those that weigh over a quarter of a ton each. This quartz is very white, and immense piles of the boulders—probably hundreds of thousands of tons—are piled over the many acres that have been washed off. The deepest claim is 80 feet deep, and probably all the ground washed off averaged 40 feet, of which at least five feet were in boulders that are larger than a man's head, and that now lie on the ground.

The only claim now at work on a large scale at Michigan Bluff is the North American, and there is little expectation of extensive work in any other claim for some years. There are places that would pay if water could be obtained conveniently, and there is much ground known to be rich, but it would not pay at present.

The price of water in 1859 was 37½ cents per inch, and it was reduced successively to 30, 25, and 20 cents; in 1865, to 17½, and in 1866, to 15 cents per inch.

The original size of the claims was 100 feet square to the man.

TAIL SLUICES.—There are four tail sluices, making a quarter of a mile altogether, in Stickness's Gulch, below Michigan Bluff. The sluice is four feet wide, three deep, with vertical sides, and a grade of 14 inches to the sluice-box. Part is paved with wooden blocks and part with boulders. From 1860 to 1863 the tail sluice paid very well, as four or five companies tailed into it, but now there is only one.

NORTH AMERICAN.—The North American claim, as originally located, was 600 feet long and 400 feet wide; but much additional ground has been purchased, and half of the original area is worked out. Sluicing and drifting were commenced in 1854 in front, where the claim was shallow; and in 1858, when deeper gravel had been reached, piping began. In 1860 a bed-rock tunnel

1,400 feet long—in one place 150 feet under the surface of the rim rock—constructed at a cost of $10,000, was first used for washing. The grade is 13 inches to 12 feet, but eight inches is considered preferable. The sluice in the tunnel is two feet wide at the bottom, 32 inches wide at the top, and two feet deep. The flaring are better than vertical sides for the passage of large boulders two or three feet through, though anything over 150 pounds injures the sluice. Nearly all the gold is caught within 200 feet at the head of the sluice, where the bottom is covered with slat frames six feet long and one foot wide, with four frames to one sluice-box. The slats are boards an inch thick, "shod" with iron straps three-quarters of an inch thick and an inch and a half wide. All the sluice-boxes below the first 200 feet are paved with fir blocks eight inches thick. The first hundred feet of the sluice are cleaned up every evening, and the second hundred twice a week. This cleaning up keeps the riffles in good order, and requires half or three-quarters of an hour. There are 2,300 feet of 11-inch pipe and 150 of 7-inch pipe in use in the claim. The total yield has been $300,000.

NITRO-GLYCERINE.—The number of men now employed is 15; last year it it was 28. One of the chief difficulties in this claim is the removal of the of the stratum of pipe-clay which rests on the pay gravel and must be carried off in the sluice. It is too hard to be piped away, so it must be blasted into small pieces. Previous to this year powder was used, but now Mr. Swenson, one of the partners of this claim, and the pioneer manufacturer of nitro-glycerine in California, supplies that fluid, which is so much better than gunpowder that 15 men do more in 1867 than 28 did in 1866. The nitro-glycerine shatters the pipe-clay into a multitude of little pieces, whereas powder broke it into a few large ones; so, after a powder blast, the miners had to reduce the large lumps with gads, for which there is now little use. It costs about $2 per pound, and is preferred by the miners after they once become accustomed to it. No accident has happened with it on this claim, although sometimes two or three dozen blasts are set off in a day. The smoke from it disappears sooner than that from powder, but it is more injurious.

About 400 inches of water are used in the North American claim for four or five days in the week.

BATH DISTRICT.—The following claims are in the Bath district, adjoining the Forest Hill district:

In the San Francisco claim no work has been done for a long time.

The Oro claim never yielded much, and is doing nothing now.

The Rip claim, 450 feet front, has a tunnel 450 feet long in the bed rock. From this tunnel a shaft has been raised to the Paragon sheet, which was worked from 1852 to 1858. The company are preparing to pipe away the front of the claim, and they intend to erect a mill next year. Work is continued meantime on the tunnel.

The Golden Gate Company have 180 feet front, and own half of a joint tunnel, 400 feet long, on the boundary line of the Rough Gold Company. They are are now working the blue gravel, and getting $5 per ton from it, but they intend to work the Paragon sheet. They have a five-stamp mill, driven by a hurdy-gurdy wheel.

The Rough Gold Company have a frontage of only a few feet, but the claim grows wider as it goes back into the hill, and 400 feet back it is 200 feet wide. There is a tunnel 1,800 feet long, 150 feet under the Paragon sheet, which is now being worked; but the tunnel was located for the purpose of working the blue gravel. There is a 10-stamp mill, which was erected in 1866, and is now running steadily.

PARAGON.—The Paragon claim has a front of 250 feet, extends a mile and a half through the hill, and is 400 feet wide at the back. The pay stratum now worked is a deposit of rusty gray gravel, four feet deep, resting on the blue gravel 100 feet deep, and covered by volcanic sand. The blue gravel immediately on the bed rock, as well as for 100 feet above, contains some gold, but not enough to offer much profit. The gray gravel contains $10 per ton, the gold being coarse, some of the pieces weighing two or three ounces, and others containing quartz attached.

Work was commenced on the claim in 1852, and the gravel was sluiced for 10 years. It was so tough, however, that it had to be washed repeatedly, and after all much of the clay escaped undissolved. At the first washing the yield was about $1 per ton, and the second, third, and fourth washings, made at intervals of a year, yielded each $2 per ton, and $1 per ton for the fifth, sixth, and seventh washings. Freezing and thawing slaked the cement more rapidly than did sun or rain. In 1864 a 20-stamp mill was built, and then the claim first began to prove its high value. The yield of the claim was $100,000 in 1866, half of it profit. The yield per ton in the mill is no more than it was in the sluice, but the dirt is now not so rich as it was before.

The gray gravel, or "sheet," as it is called, has all been taken out for 1,600 feet front. The tunnel is in the middle of the claim in the blue gravel, 20 feet below the sheet. The pay dirt is breasted out on drifts, which run entirely across the claim, so that there are 400 feet of breast for the men to work at. The gravel becomes softer when exposed to the air, so the large breast gives the benefit of exposure, as well as of abundant room. At intervals of 30 feet a chute is made from the sheet down to the tunnel, for the purpose of throwing down the gravel; few timbers are used, and the roof falls down upon the blue gravel, close upon the heels of the miners. Two men are constantly employed repairing the tunnel, which would close up in a month, if neglected. The blue gravel swells very much in one stretch of 150 feet.

There is enough dirt in sight for four years' work. All the dirt is picked down.

The mill crushes 200 tons a week, and the expenses are $1,000 per week. Fifty men are employed: 32 miners; four carmen in the tunnel; two carmen outside; two tunnel menders; four feeders, and six others in and about the mill. Two men feed the 20 stamps, and two others pick out the large stones from the gravel.

The stamps weigh 700 pounds, have 75 drops per minute, and 13 inches fall.

The screen is punched with holes a sixteenth of an inch in diameter, but they soon wear larger.

Two tons of gravel are fed per hour to each five-stamp battery, and three inches of water run steadily into each mortar.

A quarter of a pound of quicksilver is put in every morning, and as much more every evening into each battery.

A flask of quicksilver is bought once in four months, implying the loss of 75 pounds in that period, or half a pound per day on an average, or one-quarter of all that is used. The retorting is done carefully, so the loss is in the sluice.

Below the mortars are Jenny Lind riffles, and below those hurdy-gurdy riffles.

It is said the claim was sold in August, 1867, for $150,000.

OTHER BATH CLAIMS.—The Greek claim, 160 feet front, has lately been bought by the Paragon Company for $9,650. This claim paid well in front, but was not worked well; the tunnel closed up; the owners quarrelled, and then they sold out.

The New York claim, 200 feet front, has a sheet like that of the Paragon, save that it is on the bed rock. A tunnel was cut 1,800 feet long in the bed rock, at an expense of $15,000, but bad air proved very troublesome; the work was stopped before pay was reached; the tunnel closed up, and nothing has been done for three years.

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The Sebastopol Company has a front of 1,000 feet, cut a tunnel 800 feet in very hard rock, found no pay, and stopped work in 1866, after spending $20,000.

Damascus.—Damascus, twelve miles northeast of Forrest Hill, on the same divide, but on its north side, has the same slate bed rock, and a similar bed of blue cement, though there is no overlying red gravel.

The Damascus Company has a claim 500 feet in front, and 3,000 long, running into the hill. The blue cement is four feet thick, lies immediately on a soft talcose slate-bed rock, soft enough to pick, and is covered by 600 feet of volcanic sand; at least it is supposed to be sand, though no careful examination has been made of it. The richest part of the cement is within 15 inches of the bottom, but the largest nuggets of gold are found in the bed rock. The gold is mostly coarse, in long narrow pieces, and those found in the bed rock, like those found at Forest Hill, are frequently quite black.

The claim is opened by a tunnel, 450 feet long, of which distance 200 feet were passed before the rim had been pierced.

The tunnel runs nearly south-southeast, about the middle of the claim, and apparently in the middle of what was the channel of the ancient stream. The present supply of cement is obtained northeast of the tunnel, and the breast is about 200 feet, extending nearly half way across the claim. A pillar 20 feet wide is left standing alongside of the tunnel to protect it. A rail track is kept along the face of the breast, and after 20 feet have been breasted out, the track is relaid for convenience of loading. The tunnel is eight feet below the bed of the channel, and the load in the breast car is dumped into the tunnel car.

There are many large quartz boulders, some of them weighing a ton each in the cement, and these are thrown back to support the proof, which never cracks. A post six feet high, with a cap 30 inches long, is set up in each square of 30 feet at the breast, but so far there has been no trouble with the roof.

There is a 10-stamp mill, driven by steam, but it runs only in day-time for lack of water to run longer. The company intend to make a ditch, so that the mill can run day and night. Twenty-five tons of cement are crushed every day, and the average yield so far has been $3 35 to a car load of 1,700 pounds, or $3 94 per ton. The bed rock, of which 15 inches are dug up, is not crushed, but is simply washed in the sluice.

The stamps weigh 650 pounds each, make 70 to 80 blows per minute, and drop from 9 to 11 inches. When the shoes and dies are new the drop is 9 inches, and the number of blows 80, and when the drop is 11 inches the number of blows is 70.

Three inches of water are turned into each mortar, and three inches more are turned into the sluice below.

The cost of the mill, including the engine, was $12,000, and the expenses daily are the following, viz: a cord of wood, $3; an engineer, $4; a blacksmith, $3; a feeder, $3; six miners, $3 each. Five men breast out five tons per day to a man, and one carman takes out the cement. The engine is of forty-horse power. Two candles are burned per day to the breaster.

The mill was built before the mine was properly opened.

The bed rock does not swell. The bed rock is full of vertical quartz-veins averaging a few inches in thickness, running south-southwest and north-northeast. These seams appear to form in places half of the bed rock; some of them are a foot thick, and some as thin as paper. The same quartz veins, but more strongly marked, are found in a second tunnel, which is 65 feet lower and 350 feet long.

Mountain Gate.—The Mountain Gate claim, adjoining the Damascus on the west, has 2,000 feet front, and the tunnel runs in 4,000 feet. The bed rock is 35 feet higher than in the Damascus, it swells, there is less quartz in the bed rock, and some of the gravel is softer; but otherwise there is much similarity in the two claims. The tunnel was started 40 feet below the top of the rim rock, which was passed in 500 feet, and then the tunnel was extended 3,500 feet, running nearly level, and the company are now troubled so much by water that they have started another tunnel 65 feet deeper, and it is in 1,500 feet. The tunnel is about 200 feet from the Damascus line, and they have worked 200 feet on each side of the tunnel. They breast out on the same system as that used in the Damascus.

They have no mill, and when they come to cement too hard to wash, they usually leave it behind and virtually throw it away. Some of it, however, is so rich that it pays to crush with a hand mortar. The softer cement is washed three or four times, at intervals of six or eight months. Three-fourths of the total yield is obtained at the first washing, and three-fourths of the further yield at the second. The sluice is 200 feet long.

There are 16 partners, all of whom work in the claim, and they seldom hire anybody. Rumor says the present yield is $12 per day to the man, though the work done is much less than the amount required from hired men. The claim has been worked for 12 years, and has produced altogether $370,000. They have enough water from their own claim to wash all their dirt.

The bed rock rises 150 feet near the western line of the Mountain Gate, and at the eastern line of the Damascus, so those two companies take the whole channel there.

IOWA HILL.—At Iowa Hill the blue cement lies on the bed rock, or lay before it was mined out, 12 or 18 feet deep. The cement was so soft that it could be picked out, and so hard that it could be washed once a year for seven years without being entirely disintegrated. Much of the cement was so rich that it was pounded up in a mortar weighing 250 pounds, and measuring 16 inches across the bowl. The pestle weighed 70 or 80 pounds, was attached to a spring pole, and was worked by two men, who could thus pound up two tons or two tons and a half in a day.

Over the blue cement was a layer of sand from one foot to four feet in thickness. Upon that rested a stratum of rich brownish gravel six or eight feet thick. Over this came 140 feet of poor brown gravel, with layers of sand in it, and usually there was a very rich stratum of gravel just over the sand. Above the brown gravel was loam 20 or 30 feet deep.

A few claims on this Blue lead were extremely profitable. The Jamison, the pioneer claim, yielded $500,000; the North Star, $400,000; the Sailor Union, $300,000; the Iowa Hill, $250,000; and the Dutch, $250,000; but three dozen large tunnels were run and not one-third of them paid expenses. If the loss were balanced against the profit, the Iowa Hill district would not show much net gain.

The town stands on the summit of a ridge 200 feet high and a furlong wide, and the blue cement of the channel which passes under the town has all been drifted out, and the hydraulic pipe is now at work on both sides, so that the town site will itself be washed away in a few years.

The richest spot ever found in the neighborhood of Iowa Hill was in the brown gravel, from which two men took out $30,000 in one day.

East of Iowa Hill is Indian cañon, reputed to have been the richest cañon ever found in California.

WISCONSIN HILL.—Wisconsin Hill is on the same divide with Iowa Hill, but is two miles distant in a southeast direction, and the two places are separated by a ravine. The channel is the same as at Iowa Hill, but not so rich.

The Oriental cement mill at Wisconsin Hill was built in 1866 and has 20 stamps, but it does not pay, as the cement yields only 80 cents to the ton. Fortunately, the surface has been stripped, so the cement lies bare and can be obtained at little expense.

ROACH HILL.—Roach Hill, one mile east of Iowa Hill, has had some good claims.

Monona Flat, half a mile east of Roach Hill, has also paid well in places. The channel at these two camps runs with the divide.

Pleasant Flat, a quarter of a mile further up, has a channel running across.

MORNING STAR.—Three hundred yards south of Iowa Hill, beyond Indian cañon, is Picayune divide, through which runs the Blue lead, on which is located the Morning Star claim, which has 1,200 feet front, and extends 4,000 feet to the middle of the ridge. The channel here appears to have been 150 or 200 feet wide. The Morning Star tunnel was commenced in 1856, and no pay of any note was obtained until 1865, by which time a distance of 1,800 feet had been run and $45,000 had been expended. After reaching the cement it was found that the tunnel was 30 feet too high, and now the dirt has to be hoisted and the water pumped by hand to the level of the tunnel. The bed rock swells, and sometimes the track is raised six inches in a night. The cement varies in thickness from six inches to six feet, and yields $3 per ton. The mill has six stamps, goes by steam, and crushes 40 tons in 24 hours. From June to December, there is but half the needed supply of water, and the mill runs only in the day-time. Twenty-four men are employed.

BIRD FLAT AND LEBANON.—Three-quarters of a mile above the Morning Star claim, on the Picayune divide, the Iowa Hill and Bird Flat Company have been running a tunnel since 1854, have gone in 1,100 feet, have spent $50,000, and have obtained no return as yet.

The Lebanon Company, at Prospect Hill, have a claim which adjoins the Morning Star on the back. They have been at work 13 years, spent $100,000, and cut a tunnel 1,500 feet, and in 1866 they struck into pay and erected a 10-stamp mill, which is driven by a hurdy-gurdy wheel. This tunnel is not low enough.

GOLD RUN.—On the Railroad divide, between Bear river and the North fork of the American, the Blue lead appears at Dutch Flat, Gold Run, and Indiana Hill. The width of the lead here is nearly half a mile, and there are 200 or 300 feet of pay gravel, with no overlying barren stratum. Squires's cañon, which empties into Bear river, separates Dutch Flat from Gold Run. The latter did not obtain a large supply of water until lately, and therefore its best claims have not been exhausted, and it is the most prosperous hydraulic camp in California. Nine thousand inches of water are used here, requiring a payment of $1,000 a day or more in gold. The gravel is peculiarly soft and there is great depth, so that high power is obtained, and more dirt is washed in proportion to the quantity of water used than in any other large hydraulic district.

GRAVEL AT GOLD RUN.—The bed of auriferous gravel at Gold Run is about 350 feet deep, of which only about 150 feet have been worked so far. The sluices are therefore 200 feet above the bed rock. A shaft was sunk 185 feet deep in Potato ravine to the bed rock, and the bottom of that ravine is below the level of most of the sluices. It is to be presumed that the bed rock in that shaft is no lower than elsewhere in the channel. Pay gravel was found all the way down, and it was soft until within six or eight feet of the bottom. This vast bed of gravel two miles long, half a mile wide, and 250 feet deep, cannot be washed away for many years.

OUTLET.—Although the cañon of the north fork of the American river is at least 2,500 feet deep, yet it is two miles distant from Gold Run, and the tailings must run into Cañon creek, which near the claims is only 150 or 175 feet below their levels. Several claims have been compelled to stop work because they no longer have any outlet.

An outlet must be obtained 200 feet deeper than Cañon creek, and it must be had without waiting for the gradual washing out of the Blue Lead channel from the cañon of the north fork of the American river. That outlet will be through a tunnel about a mile long, and from this tunnel shafts will run up to the various claims. It will be very costly, but on the other hand it will yield an immense return.

FACILITIES FOR PIPING.—There is no prettier hydraulic washing than that at Gold Run. The gravel is very soft, it is deep, water is abundant with a high pressure, the claims are large, and there is no superincumbent layer of barren matter. In proportion to the amount of work done fewer men are employed at Gold Run than at any other camp in the State. At Smartsville much time is spent in blasting; at La Porte, in puddling; at Dutch Flat, in attending to large boulders; but none here. Two men are sufficient here to do all the work in a claim that uses 300 inches of water. As an inch of water is equal to a supply of 145 pounds per minute, or 8,700 pounds per hour, or 102,900 pounds (51 tons) in 12 hours, so it follows that 300 inches supplies 15,000 tons in a day; and as the water carries off at least one-tenth—the ordinary calculation is one-fifth—of its bulk of earthy matter, it follows that two men wash 1,500 tons at Gold Run in 12 hours, or 750 tons each. It is a common saying at Dutch Flat that there three pipes are required to break down as much gravel as the water of one can wash away, but in Gold Run one pipe will break down as much as three can wash away. This is an exaggeration when stated as a general principle, though it has been true in some instances.

CAÑON CREEK.—Cañon creek runs from Gold Run along the eastern border of the Blue Lead 3½ miles down to Indiana Hill, where it empties into the north fork of the American river. This creek furnishes the outlet for many of the claims. The original bed of the creek was in general 350 feet below the surface of the lead, or "gravel range," as it is also called, but the bed has been in some places filled up as much as fifty feet with gravel.

WATER.—Piping was commenced at Indiana Hill on a small scale in 1857, with 400 inches, supplied in the late winter and early spring by a ditch from Cañon creek. Four years later the Dutch Flat ditch brought to Gold Run 800 inches, which ran for six or seven months, and have since been doubled; and the Bear River ditch brought in 800 more; and in 1864 the South Yuba ditch brought in 2,500 inches. The demand for water has always exceeded the supply, and as the supply increased so did the amount of work and of production. Gold Run produced $150,000, in 1865; $300,000 in 1866; and the yield for 1867 is estimated at $500,000. The customary price for water is 12½ cents per inch for 12 hours, and 20 cents for 24 hours.

SQUIRE'S CAÑON CLAIMS.—On the southern lode of Squire's cañon, in the Gold Run district, are the following claims, commencing at the east:

Frost & Co. began work in 1865, wash through an open cut, use 300 inches of water, and usually run in day-time only, though they have run night and day at times.

W. H. Kinder began work in 1866, uses 300 inches of water, washes through an open cut, and runs in day-time only.

Wentworth & Co. began work in 1866, use 300 inches of water night and day, and wash through an open cut.

A. Bell & Co. are running a bed rock tunnel, and have not commenced washing.

Wolcott & Co. began work in 1867, and the claim was sold in June for $3,500. They use 300 inches of water in daylight only, and wash through an open cut, but intend to cut a tunnel.

The Bailey claim, consisting of 21 claims, each 100 by 200 feet, has not been opened, and no work is being done.

Crader & Co. began in 1867, and use 175 inches day and night.

CAÑON CREEK CLAIM.—The claims which have their outlet into Cañon creek are the following, near the head of Squire's cañon:

The Rock Company opened their claim in 1866, and used 250 inches of water, running day and night. They are not piping now, but are preparing to lay a long pipe so as to have a heavy pressure for 1868.

Hughes & Co. opened their claim in 1866, but are not at work now.

A. S. Benton opened his claim in 1867, and uses 300 inches of water by daylight only.

The Harkness claim has been worked by sluice and pipe for 10 years, is now taking 650 inches of water day and night, and draining through an open cut.

Behind Harkness is the claim of Halsey & Co., 900 feet long by 500 wide, which cannot be worked until an outlet is obtained through the claim in front. A fourth interest was offered for sale in last February for $2,000, but no buyer appeared. It would have found ready sale if there had been an outlet.

Next to Harkness, on Cañon creek, is the claim of Goding & Co., who have worked off the top of their claim as low as they can go, and are now waiting for a deeper outlet.

The claim of Benton & Co., adjoining, is in a similar condition.

The Bay State claim was opened in 1857, and has been worked steadily since whenever water could be had. In 1866 it used 750 inches day and night; this year it used 350. The profit never has been large, though the gross yield has been $150,000, and the yield for 1866 $37,000.

The claim of A. Beel is in the same condition as that of Goding.

GOOSLING RAVINE CLAIMS.—Goosling & Co. have been at work since 1854. A ravine runs down through the middle of the claim, and they are piping on each side, using 300 inches day and night on one side, and 300 inches in day-time only on the other. Goosling ravine is in this claim.

Prindle & Co. opened their claim in 1864, and used 275 inches of water day and night. Work has been closed for this season because the pipe has advanced to within 50 feet of a ditch, the proprietors of which have warned the claim owners that they will be held responsible for any damage to the ditch. Four ditches cross this claim. The outlet is through Goosling's ravine.

The Uncle Abe claim, behind Goosling, is irregular in shape, but is about 1,000 feet long by 850 feet wide. It was opened in 1867, and in April, May, and June, yielded $12,000. It was sold in May for $6,000. The consumption of water is 275 inches day and night.

LOWER CAÑON CREEK CLAIMS.—The claim of Winters & Co. has been worked three years, and is in the same condition as Goding's.

The Bay State No. 2 is unopened. An offer of $3,000 for the claim was refused.

The Hall claim was worked for two years, but is idle this season for want of an outlet.

The claim of Taylor, Moore & Co. is about 1,000 feet square, was worked on a small scale from 1853 till 1865, and for the last two years has been piping on a large scale. It was sold this year for $11,000. The yield in "a run of 22 days," as a run of 11 days day and night is termed, is usually between $4,000 and $5,000.

The Church claim was opened in 1860, and the yield in 1866 was $27,000. Three-fifths of the claim were sold in 1865 for $7,000. Of water, 275 inches are used in the day-time only.

The Golden Gate claim began work in 1858, uses 300 inches of water in day-time only, pays well, and is the last claim that tails immediately into Cañon creek.

GOLD RUN CAÑON.—The Gold Run claim began work in 1859, uses 300 inches of water in the day-time only, has paid well, and tails into Golden Run cañon, which is on the southern side of the claim. An offer of $10,000 for the claim has been refused.

The Fitzpatrick claim, fronting on Gold Run cañon, has lately been sold for $2,100, and is now preparing to work with 300 inches of water.

On the south side of Gold Run cañon, and opposite to the Fitzpatrick claim, is the Sheldon claim, owned by the Dutch Flat Water Company. It has been worked several years, but is idle now.

The Huyck and Hubbard claim, fronting on Gold Run cañon, has a sluice tunnel, but is waiting for cheaper water, and doing nothing.

The Home Ticket has been worked four years, and uses 350 inches in day-time. The gross yield in May and June, 1867, was about $100 per day.

The Newark was opened in 1863, uses 300 inches in the day-time, and yielded about $75 gross in June, 1867.

POTATO RAVINE.—The following companies tail into Potato ravine, a tributary of Cañon creek:

Baldwin and Bailey have been at work three years, using 275 inches of water in the day-time, and obtaining about $70 gross per day.

The Harris claim is large and unopened.

The Fitzpatrick claim yields about $75 gross per day, was opened in 1866, and consumes 330 inches of water in day-time.

The Cedar Company have 900 by 800 feet, began work in 1861, run 300 inches day and night, and obtain about $230 in 24 hours. The yield in 1866 was $35,000, one-half of it profit.

Stewart and Kinder have 500 feet square, fronting on both Cañon creek and Potato ravine, but are not at work. Along Cañon creek there is a rim rock, so they will tail into Potato ravine. They refused an offer of $1,500 for the claim.

The Judd and Griffin claim, 1,000 feet square, has been worked since 1854, and was sold in 1866 for $3,500. The yield is about $75 per day, with 270 inches running twelve hours out of the twenty-four. To get drainage an open cut was made 600 or 700 feet long in the rim-rock, and in one place 40 feet deep.

Huyck and Judd have one of the most profitable claims of the district on the eastern side of Indiana Hill cañon, which empties into the north fork of the American river. They have been at work since 1854, use 275 inches of water in the day-time, and cleared $7,000 in 1866.

The Hoskin claim adjoining is open, but is not worked.

INDIANA CEMENT MILL.—Mallory, Gaylord & Co. are working with an eight-stamp cement mill, driven by a hurdygurdy wheel. Their claim is the only one in the district in which the bed-rock has been reached. Their mode of getting out dirt is to cut a tunnel 60 or 70 feet on the bed-rock, let off a blast of 200 kegs of powder, sluice off the top dirt, and run the cement through the mill.

INDIANA CANON CLAIMS.—The following claims tail into Indiana Hill cañon.

The Hawkins claim was opened this year, uses 350 inches night and day, and yields $200 in 24 hours.

The Brink claim was opened in 1864, but is not worked now on account of disturbance of the telegraph or flume from which the pipe is fed. The yield was about $75 per day, and the quantity of water 30 inches. Work will be resumed next year.

Stewart and Prindle opened their claim in 1867, use 200 inches day and night, and take out about $100 per day.

MOODY'S TAIL SLUICE.—In Cañon creek Moody & Co. have a double tail sluice 2,000 feet long, consisting of two flumes, each eight feet wide and about four feet deep. This sluice cost $25,000. The lower part was carried away in 1862, and the upper part was buried and had to be replaced. The yield was $10,000 in 1865, $7,000 in 1866, and $3,000 in the first half of 1867. An offer of $11,000 for a third interest was refused. The estimated receipts for 1867 are $10,000. Most of the cleaning up is done in September and October, when there is not much water for piping.

KINDER'S TAIL SLUICE.—Kinder and White have a tail sluice in Cañon creek, and claim the creek for a mile and a half below Moody & Co. In the upper part of their claim they have two sluices eight feet wide and 700 feet long. Half of the sluice was sold in 1865 for $3,000, but since then it has become more valuable. The grade is three inches to 12 feet. This sluice was carried away in 1865.

The following companies tail into the two tail sluices in Cañon creek:

Companies.	Inches.	Companies.	Inches.
Rock Creek	275	Golden Gate	300
Benton & Co	350	Home Ticket	350
Harkness	600	Newark	300
Bay State	350	Bailey & Brother	275
Bell	300	Fitzpatrick	300
German	600	Brogan	300
Uncle Abe	275		
Taylor & Co	400	Total	5,250
Church	275		

The Gold Run tail sluice, in Gold Run cañon, is 1,500 feet long, six feet wide, and yields $6,000 or $7,000 a year. It tails into Cañon creek.

Goosling & Co. have a tail sluice 3,000 feet long in Goosling ravine, and four companies tail into it. Two tail sluices are buried 20 or 30 feet deep in this mine.

Huyck and Judd have 1,000 feet of tail sluice in Indiana Hill cañon.

HOSKINS TAIL SLUICE.—The Hoskins tail sluice is in Indiana Hill ravine, which is so steep that the sluice is in short sections, the longest 24 feet, and between the sections the water pitches down over steep rocks. There are in all fifteen boxes of main tail sluice, six or eight feet wide and two or two and a half feet deep, with a grade of eight inches to 12 feet.

Besides the main sluice boxes there are a number of undercurrent boxes, from six to nine feet wide, 14 inches deep, with a grade of 12 or 13 inches to 12 feet. Not more than one-fifth of the matter in the main sluice gets into the undercurrent, passing through a cast grating of white iron, with openings an inch wide, eight inches and a half long, separated by bars an inch and a half thick on top. There are usually from 600 to 1,200 inches of water running in the main sluice and 120 in the undercurrent, which latter catches three times as much gold as the former, because the current is slower and shallower.

There are second undercurrents, or secondaries, as they are usually called. Their grade is 14 or 15 inches to the box, their width 30 inches, and their depth 12. They take one-fifteenth of the water of the undercurrent, and catch one-eighth as much gold. They are especially serviceable for catching quicksilver. The spaces in the grating are five inches long and three-eighths of an inch wide. There are three boxes of 12 feet to each undercurrent, and two to each secondary. The undercurrents always pay where the gold is fine, and the secondaries are especially serviceable in steep cañons.

DUTCH FLAT.—Dutch Flat, on the north side of the divide between Bear river and the north fork of the American river, and within half a mile of the line of the Central Pacific railroad, has for 12 years been one of the leading hydraulic camps of the State. It is pleasantly situated, and is one of the most prosperous towns in the mines, although the monthly gold yield was thrice as great in 1858 as it is now. There are many comfortable homes, most of the people consider themselves permanent residents, and there is a steady increase in the number of families. Dutch Flat, probably alone of all the mining towns, has never been burned down, and only one house has been burned. The shipment of gold in January, 1867, was $31,600; in February, $33,000; in March, $43,000; in April, $74,000; in May, $66,000; and in June, $60,000. These shipments included much from Gold Run.

Most of the soft gravel that covered the Blue lead, and that could be washed down readily with the pipe, has been washed away, and the blue cement, which is too hard for the pipe, and perhaps not rich enough for the stamp, has been reached; and most of the claims are now lying idle in the hope that some other mode will be devised of working them.

The principal claims at Dutch Flat, commencing on Bear river, at the northeastern corner of the district, are the following:

PHŒNIX AND AMERICAN.—The Phœnix, 900 feet long by 300 wide, was opened in 1857 and was worked until 1865, with an average yield of $150 and an expense of $60 per day. All the soft gravel has been washed and the hard cement remains. The depth to the bed rock is not known.

The American, 900 feet long by 400 feet wide, was opened in 1857, and was worked for six years as a hydraulic claim, yielding $150 per day. It will not pay now for piping, and Chinamen are sluicing in it.

BUCKEYE.—The Buckeye was opened as a sluicing claim in 1854, and it was piped from 1857 till 1867, and may be regarded as worked out for the hydraulic process. It has used 250 inches of water and employed from four to six men. An incline was sunk 250 feet below the level of the present workings to the bed rock, and the cement taken out in going down yielded $8 to the car-load, and not more than one-third of the gold was washed out. If this statement be correct, and if the cement found in the incline was a fair average of all in the claim, the Buckeye is an extremely valuable piece of property.

DUTCH FLAT AND QUEEN CITY.—The Dutch Flat, 1,800 by 900 feet, was opened in 1857, and is still at work with 12 men. The yield is from $200 to $400 per day. The soft gravel will last another season. The company commenced work in 1854, cutting a tunnel for drainage, but after going 450 feet and spending $46,000 on it, they gave it up. Some of the rock was so hard that they paid $85 50 per lineal foot.

The Queen City, 900 by 250 feet, began piping in 1858, and will exhaust its soft gravel this year. Four men are employed; the yield is $130 to $150 per day, and 200 or 250 inches of water are used.

BEAR RIVER AND TEAFF.—The Bear River claim, 900 by 400, was opened in 1856, and will be exhausted, so far as the soft gravel is concerned, this year. Four men are employed, 250 inches of water are used, and the yield is $150 per day.

Teaff's claim, 900 by 310 feet on one side of the hill, and 1,500 by 900 on the other side, was opened as a pipe claim in 1855, and the soft gravel will be worked out next year. From 1857 to 1860 125 inches of water were used, and the average yield was $100 per day. About 80 feet have been washed away from nearly the entire area of the claim. The amount of water used is 250 inches, at an expense of $30 per day; four men are employed at $3 each; the total expenses are about $50 per day, and the yield $150. The head of water for piping is 120 feet.

FROM BOSTON TO YANKEE.—The Boston claim, 900 by 450 feet, was opened as a hydraulic claim in 1855, and the soft gravel will all be washed away this year. Four men are employed, 250 inches of water are purchased, and the yield is $150 per day.

The Gray Eagle, 900 by 300 feet, was piped from 1858 till this year, and now the soft gravel has all disappeared. The yield was $150 per day, and 250 or 300 inches were used per day.

The North Star was worked as a drift claim for a long time, and then piped. The soft gravel is all gone, and the claim is lying idle.

The Union is working, and paying good wages to two men.

The Yankee, at the junction of Dutch Flat ravine with Bear river, has worked off nearly all the soft gravel. In 1858 and 1859 it was worked as a drift claim by 16 men, and it yielded 250 ounces (about $4,500) per month.

DRIFT CLAIMS.—The Blue Cut struck pay in 1856 as a drift claim, and paid very high for a time, and now pays $400 per month. Four men are employed, and the claim is still worked by drifting.

The Potosi, a drift claim, pays 200 ounces per month to 12 men drifting day and night.

The Whynot Company is worked as a drifting claim; yield not ascertained.

The Badger has 22 feet of drifting dirt, and has been very rich, but is working now on a small scale. In four years it paid $192,000 of dividends

Mill Claims.—The Ohio claim has a four-stamp cement mill, which started this year and pays well. The cement is hauled out with a mule. The soft gravel has been sluiced off from the top.

The erection of a mill has been commenced on the Baker claim.

The German Company intend to build a mill.

Other Claims.—The Deep Shaft claim is the property of the Water Company, and is worked by the hydraulic process, but the supply of water is irregular. When there are 250 inches of water the yield is about $150 per day.

The Iowa claim uses 250 inches, and pays $150 per day, but did not pay more than $100 previous to 1866. The soft gravel will be worked out next year.

The North Star yielded $150 per day for four or five years, but the soft gravel is all gone now.

Between Dutch Flat Ravine and Squire's Cañon are a number of hydraulic claims that have been worked many years, and have paid very little more than expenses.

Teaff's Tail Sluice.—James Teaff, who owns one of the piping claims at Dutch Flat, also owns a tail sluice—probably the largest one in the State. The total length is 5,500 feet; 2,500 feet long, five and a half feet wide, and 26 inches deep, in a tunnel, and 3,000 feet long and six feet wide outside. The construction of the tunnel and sluice cost $55,000 in money and four years' time, and was completed in 1863. The Teaff, Dutch Flat, Queen City, Bear River, Franklin, Boston, and Iowa companies, with 1,550 inches of water, tail into it. It is paved all the way with boulders 14 inches deep. The grade is 10 inches to 12 feet, but eight inches would have been better. At intervals of 120 feet there are falls or dumps two feet and a half high in the tunnel and five feet high outside. These dumps are of great service in breaking up pieces of cement.

Boulders 10 and 15 inches in diameter are constantly rushing through the sluice, and some of 20 inches frequently pass. The great weight of these boulders rushing along at a speed of nearly 10 miles an hour tries the sluice severely, and the rock bottom is always worn down about two inches in three months, and half of the paving boulders are broken so as to be unfit for further use.

The rock for the paving is obtained by putting an iron grate in a sloping position in the sluice. The bars of the grate are an inch and a half thick and eight inches apart, so everything small passes through. A Chinaman stands by the grate, examines every boulder that stops, lays the good ones on one side, and throws the others over.

Every evening 15 or 20 pounds of quicksilver are put into the sluice, and the largest amount in the sluice at one time is 900 pounds. The owner of the sluice never buys any quicksilver, but has it to sell, for he catches more than he puts in. He cleans up several sections—a section is between two dumps—between Saturday night and Monday morning, which time he has for cleaning up under a contract with the companies. Six men are employed 20 hours—12 days' work—in cleaning up a section of ten boxes or 120 feet, and the expense, including new stone and repairing, is $3 75 per box. The yield is usually $25 per box, or $250 per section, at a clean up, and there are 416 boxes in the sluice. Three men are constantly employed in looking after the sluice, and extra men are engaged to clean up.

The companies which tail into the tunnel have about 600 feet of their own sluices.

Drainage of Bear River.—Bear river, opposite to Dutch Flat, is 70 feet deep, with tailings, the mass of which extends for some miles above and many below. It has been proposed to cut a tunnel three miles long from Bear river at Secret ravine through the railroad divide to the north fork of the American river, the bed of which is 1,000 feet lower than that of Bear river. It is supposed that an immense profit would be derived from such an enterprise, though the cost of making a tunnel for that length 11 feet wide and eight feet high, at $40 per foot, would be about $630,000. The bed of Bear river, opposite Dutch Flat, never was flumed, and is probably quite rich. The present deposit of tailings began to accumulate in 1858 or 1859. They rise about two feet per month from February till September, and then the floods of winter carry away a considerable portion of them.

SOUTH PLACER QUARTZ REGULATIONS.—There is no general quartz regulation for Placer county; each district has its own rules.

The following are the main provisions of the South Placer quartz regulations:

> Any person may take up and pre-empt one claim of 200 feet in length on the lode by 200 feet in width, (following the dip of the lode,) with all dips, spurs, angles, and courses, with all precious metals therein contained. Such claims shall be valid by the locator's posting one notice thereupon, naming the number of feet claimed each way from said notice; designating, if possible, by croppings, the general direction of said lode, but if no croppings are visible, then by the words easterly, westerly, northerly, or southerly, as the case may be; but in no case shall a location of a claim be invalid by reason of any misapprehension in regard to the direction of said lode. Notices of locations shall be put upon the records of this district, together with filing a copy of the same with the recorder, which shall give as full a description as possible of the claim.
>
> All claims shall be recorded as above specified within 20 days from the date of their notice.

All claims in this district shall be held by working the same, the work to amount to at least one full day's work to each claim in each company in every month in good faith; and after the sum of $50 to each name in such company shall have been expended upon the claim, on application to the recorder it shall be his duty to go and see the work, and if he finds that the said amount of work or money has been expended as before stated, he shall give to the parties owning or their representatives a certificate stating that the said amount of work and money has been expended, which entitles the owners to lay over and suspend work for the term of six months from the date of said application, and the claim will not be considered forfeited until after the said six months has expired.

CANADA HILL AND LONE STAR REGULATIONS.—The quartz regulations of Canada Hill allow 200 feet on the lode to each person, and 50 feet on each side, and 10 feet on every cross-lode; and require five days' work per month for each individual claim or share.

In the Lone Star district, west of Auburn, the regulations allow 200 feet to each person, and 300 feet on each side. A company's claim may be held for the first year by doing work of the value of $25 within 60 days after the location; and an equal amount of work will hold it for any subsequent year.

GREEN EMIGRANT.—The Green Emigrant mine, three miles northwest from Auburn, is 1,000 feet long on a vein which appears to run north 65° west, but there are a number of veins that seem to concentrate at the top of the hill, in which a rich deposit has been found.

The vein which runs through the hill is called the Green Emigrant, is three feet wide, and dips 45° to the southwest. The foot-wall is serpentine and the hanging wall talcose slate and schist. The vein itself near the surface seems to be decomposed quartz, talcose, and schist. The middle parallel vein is 18 inches wide and nearly vertical, and the vein matter is like that in the Green Emigrant. The southwestern vein is four feet and a half wide, and dips 45° to the east. The vein matter is the same as in the other two. There are spaces of 50 feet between these parallel veins at the surface, but it is supposed that they unite 150 feet below the surface. The walls of the middle vein and the hanging wall of the southern vein are talcose slate; and the foot-wall of the latter vein is a hard rock resembling sienite. A shaft was sunk 10 feet in the southwestern vein, and the rock averaged $10 per ton. The mine was discovered in 1864, and not more than 50 tons have been crushed, yielding $100 per ton. The yield for the first two years was $20,000, but the proprietors refuse to tell what it has been since. Rumor, which probably exaggerates grossly, says that $100,000 have been taken out in a hand mortar in the first six months of 1867. That many rich specimens have been obtained is indubitable. All the work in the mine, except on rare occasions, is done by two partners in it, and strangers are not permitted to enter. The rich deposit is found in streaks near the walls. The mine is opened by a tunnel 225 feet long. The mine owners say the whole hill will pay—the rock for crushing and the gravel for washing.

The first extension of the Green Emigrant on the north is 600 feet long, and is being opened or examined by cross cuts. Some auriferous talcose slate has been found, but so far no vein.

Monahan & Co. have 2,000 feet on the same vein, and have done nothing.

The Wells claim is 2,400 feet long, and the vein is five feet wide. There are two shafts, one 50 and the other 40 feet deep. Forty tons have been crushed, and they yielded $12 50 per ton on an average, after the specimens had been picked out.

The first extension south of the Green Emigrant is 2,000 feet long. A shaft has been sunk 25 feet, and the vein is 18 inches wide. The rock prospects well.

New York and Empire.—The New York mine, formerly known as the Conrad, one mile west of Auburn, has three veins, each two feet wide, not more than 200 feet apart.

The Empire Company, at Ophir, has 11,000 feet of claims on various veins, and is working in a shaft 35 feet deep, in a vein two feet wide. The mill has 10 stamps, and began to run in March of this year. The average yield is $8 per ton, exclusive of the sulphurets, which are not saved. An experiment was made in this mill of working the float quartz, which covers the whole country near Ophir, but it did not pay. The working vein is in granite and runs north and south. The mill was burned down in July, after it was visited.

Schnable.—The Julianne or Schnable mine, on Jenny Lind Flat, near Ophir, is 2,000 feet long on a vein two and a half feet wide, running north and south in granite, and dipping 80° to the east. A shaft has been sunk 105 feet, and drifts have been run 50 feet below the surface, 1,200 feet on the vein, in pay all the way. The pay is evenly distributed through the vein, and the average yield of free gold, as reported by the proprietor, is $6 per ton; but the general impression in the neighborhood is that the mine is quite valuable. The expense for stopping out is $2 per ton, and the total expense $4. The croppings have paid for 2,000 feet on the surface. The rock contains seven per cent. of sulphurets, which assay $147 per ton, or $10 per ton of rock. There is a five-stamp mill which has been running for two years and a half, working 25 or 30 tons per week.

Walter and St. Lawrence.—The Walter mine, 900 feet, at Hamberg Flat, is on a vein which runs northwest and southeast, averages 18 inches in thickness, and dips 80° to the southwest. A shaft has been sunk 45 feet, and drifts have been run 48 feet on the vein in pay rock all the way. There is slate wall on both sides, but in some places the granite comes to the west wall. Some very rich specimens have been found. The mine has no mill. Twenty tons have been crushed, and the yield was $13 per ton.

The St. Lawrence Company has three claims. The St. Lawrence vein, on which they are working, runs northeast and southwest, dips southeast 65°, and is 20 inches wide. The claim on this vein is 1,400 feet long. A shaft has been sunk 75 feet, and drifts have been run 85 feet in pay all the way. The walls are granite, with a slaty gouge about an inch thick on each side. The surface was worked with a profit by Mexicans for many years. The St. Lawrence claim on the Boulder vein is 2,400 feet long. The vein is three and a half feet wide, and has the same course, dip, and walls as the St. Lawrence. A shaft has been sunk 75 feet, and drifts have been run 75 feet. An assay of the sulphurets shows $138 gold and $158 silver per ton. An assay of dry slum showed $19 gold and $46 silver per ton.

Golden Rule.—The Golden Rule Company, of Sacramento, (to be distinguished from the Golden Rule Company of San Francisco, which has a valuable mine on the Mother lode in Tuolumne county,) has claims, each 2,000 feet long, on three parallel veins nine miles south-southwest of Auburn. The eastern vein is three feet thick, and has been opened by a shaft 250 feet deep and drifts 160 feet long on the vein, all the way in rock that averages $12 to the ton. The middle vein is two feet thick, and the rock averages $8. This is 100 feet from the eastern vein, has been reached by a cross-drift from it, and a drift in the vein has been run 60 feet. The western vein is 60 feet distant, is fifteen inches wide, and has been opened to a depth of 75 feet by a shaft, and to a length of 50 feet by drifts. The eastern and middle veins show quartz of the same quality; the western has a bluish hard quartz, containing more free gold than the others, which have white quartz and sulphurets. A 20-stamp mill is going up, and also a reverberatory furnace, with a capacity to roast a ton at a charge. The sulphurets are to be concentrated with Hungerford's concentrator. There is a 75-horse power steam engine and steam hoisting works. For hoisting, a flat wire rope is used.

Stewart's Flat, American Bar, and Damascus.—Stewart's Flat mine, 1,350 feet long, is on a vein two and a half feet wide, running north-northeast and south-southwest, in granite walls. A shaft has been sunk 120 feet, and drifts have been run 380 feet on the vein in pay all the way. The average yield is $15 per ton. The mine was worked from 1862 to 1864, and was then left idle till this spring, when work was resumed. There is a five-stamp mill.

At American Bar, two miles below Michigan Bluff, a quartz mill is being built.

The Damascus quartz mine, at Damascus, was worked for three years, paying a profit part of the time, and has been idle for the last three years. The vein is 12 feet wide and the mill has five stamps.

Red Stone.—The Red Stone, 10 miles north of Dutch Flat, on the north branch of the north fork of the American river, is 2,400 feet long, on a vein which runs northwest and southeast, and is five and a half feet wide, between granite and talcose slate. A depth of 165 feet has been reached, and drifts have been run 30 feet in the vein. The rock, so far as examined, is very rich. A four-stamp mill has been running, and an 18-stamp mill is now in the course of erection.

There is a mill of two stamps erected in Bear Valley, for the purpose of prospecting the Champion and the Blue Belle lodes, both of which yield excellent quartz.

Canada Hill.—Canada Hill, on the Forest Hill ridge, 10 miles west of the summit, has a number of quartz lodes, some of which are very promising at the surface. The gulches about the hill are full of rough gold and gold-bearing quartz. Most of the miners there are Mexicans. The Secret mill, built four years ago, ran two years and is now standing idle.

The Buena Vista Company are opening a quartz claim.

Bald Mountain, two miles east of Canada Hill, is covered with float-quartz, and many of the pieces contain specks of gold plainly visible. There has been much prospecting for lodes, but none of any size have been found.

Harpending Mine.—The Gold Quarry Company's property, familiarly known as the Banker or Harpending mine, is situated near Lincoln, on a deposit similar to that of Quail Hill, in Calaveras county. The ores are delivered by contract at 40 cents per ton. A 40-stamp mill is at work, crushing about five tons daily to the stamp. The labor is principally Chinese. The estimated cost of the entire extraction and treatment is within $1 per ton.

Professor Silliman, in a paper on the Harpending and Quail Hill deposits, says:

> Accompanying the entire mass of decomposition at both localities, occur both gold and silver, disseminated with remarkable uniformity in all parts of the ore ground. At Whiskey Hill films of metallic silver are visible upon the talcose masses, stained green by malachite

or chrysocolla. The gold is rarely seen *in situ*, being mostly obscured by the very rusty and highly-stained character of the associated materials. But it is rare that, on washing a small quantity of any of the contents of these great deposits, gold is not found in angular grains or small ragged masses, from the size of a few grains' weight to impalpable dust. Nuggets of several pennyweights occur occasionally. This gold has evidently accompanied the sulphurets and been left in its original position and condition by their decomposition. There can be little doubt that the gold of the gulches adjoining these deposits has been derived from them. At Whiskey Hill the gulch gold ceases to be found as soon as the limits of this deposit are passed; and the same is true at Quail Hill. The occurrence of deposits of this nature throughout the range of the foot hills seems to offer the best solution which has suggested itself of the origin of the placer gold, which is found in situations so far removed from the gold belt of the upper sierras, and away from sources usually recognized as those to which placer gold may be referred.

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The chemical results of the extensive decomposition of metallic sulphids which has in former times occurred at these localities offer an interesting problem in chemical geology. The sulphur has been removed chiefly as sulphuric acid, beyond doubt, which has combined with iron and copper to form sulphates of those metals. These have, for the most part, disappeared, being washed out by the atmospheric waters, and have followed the drainage of the country. At Whiskey Hill I found the sulphate of iron, (coquimbite,) sulphate of copper, (cyanosite,) and alum. The water of the shaft contains copper enough to redden the iron tools.

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From all the evidence presented, we seem justified in regarding these remarkable metallic deposits as segregated veins, holding a pretty uniform and high tenor of gold and silver, associated with and derived from the decomposition of extended masses of metallic sulphurets and quartzose matter, and carrying, at times, ores of copper, the commercial value of which is, however, entirely subordinate to that of the precious metals which are found to characterize these veins or ore channels.

SECTION IX.

NEVADA COUNTY.

Nevada county, California, has for its eastern boundary the dividing line between California and Nevada State; extends across the summit and down the westerly slope of the Sierra Nevada mountains to the foot hills that border the eastern edge of the Sacramento valley. Its northerly and southerly boundaries are the Middle Yuba and Bear rivers, to the sources of those streams; thence due east to the State line. Its length from east to west is about 65 miles, having an average breadth of 20, and containing about 1,300 square miles. It is near the middle of the great gold region that stretches along the westerly slope of the mountain chain, extends entirely across the auriferous belt, and in the last nineteen years has produced more gold than any tract of country of equal extent in the world.[*] The elevation above the level of the ocean ranges from 800 to 1,000 feet, along the foot hills, and rises to 8,000 and 9,000 feet in places on the summit, thus affording a great variety of climates. On and near the summit the ground is covered with snow for more than half the year, while at the foot hills snow and ice are seldom seen.

Several streams, which have their sources high up in the mountains, flow westerly through the county, and empty into the main Yuba or Bear river. The most considerable of these are the South Yuba, Deer creek, and Greenhorn, which, with their tributaries, have cut deep channels in the primitive rock. Between these streams and those forming the northerly and southerly boundaries of the county are four main ridges running nearly at right angles with the mountain chain, and varying in length from 25 to 40 miles. These ridges are composed mainly of gravel and alluvial deposits, the debris from the higher mountains, and matter of volcanic origin. In places the bed rock rises nearly to the surface, but in general the alluvium is from 100 to 200 feet in depth, and at the higher elevations is covered with basaltic rocks and a deep volcanic cement. The volcanic covering is supposed at one time to have extended over a much larger area than at present, forming extensive table lands, but in course of time has been worn away on the lower portions and along the margins of the ridges, leaving the alluvium as the upper surface, and which now constitutes the principal field for hydraulic mining.[*]

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[*] Professor B. Silliman says of the product of the valley district:

"The place has obtained a well-earned celebrity as the most prosperous of all the gold quartz-mining districts in California. Quartz mining was begun here as early as 1850, and has been continued, on the whole, with a steadily increasing success, to the present time.

"It is difficult to obtain exact statistics of the total product of the Grass Valley quartz mines, but it is believed by those best able to form a trustworthy opinion on this subject that the product in 1866 was probably not less than $2,000,000, while for the whole period from 1851—say 14 years—it was probably in excess of $23,000,000."

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[*] Professor Silliman, in an article published in Bean's Directory of Nevada, says of the general geological character of the Grass Valley district:

"The gold-bearing rocks at this place are mostly highly metamorphic schists or sandstone passing into diorite or greenstone syenite. These greenstones, seemingly crystaline, are probably only highly altered sedimentary rocks, containing a large amount of protoxide of iron with sulphuret of iron. In some parts of the district slaty rocks occur, more or less talcose or chloritic in character; masses of serpentine also abound, forming at times one wall of the quartz veins. This serpentine is probably metamorphic of the magnesian rocks last named. The red soil, seen almost everywhere in the Grass Valley district, has its origin from the peroxidation of the iron contained in the greenstones and diorites, and set at liberty by its decomposition.

"The line of contact between the gold-bearing and metamorphic rocks of Grass Valley and the granites of the Sierra Nevada is met on the road to the town of Nevada, about a half mile before coming to Deer creek. The talcose and chloritic slates are seen to the north, in the direction of the Peck load, and in the slate districts of Deer creek.

"The dip and strike of the rocks in the Grass Valley region is seen to vary greatly in different parts of the district. Following the course of Wolf creek, a tributary of Bear river. it will be observed that the valley of this stream—which is Grass Valley—as well as of its principal branches, follows, in the main, the line or strike of the rocks. In the absence of an accurate map of the region it may not be easy to make this statement evident. But all who are familiar with the chief mines of this district will recall the fact that the course of the veins in the Forest Springs location, at the southern extremity of the district, is nearly north and south—N. about 20° E.—with a very flat dip to the east; while at the Eureka mine, on Eureka Hill, about four miles to the northward, the course of the vein is nearly east and west, with a dip to the south of about 78 degrees. Again, commencing at North Gold Hill and following the course of the famous vein which bears the names of Gold Hill, Massachusetts Hill, and New York Hill, we find the veins conforming essentially to the southerly course of the stream, with an easterly dip. The North Star, on Weimar Hill, has likewise the same general direction of dip. Near Miller's ravine, at El Dorado mill, Wolf creek makes a sudden bend to the left or east, leaving the Lone Jack, Illinois, Wisconsin, and Allison Ranch mines to the west. All these last-named mines are found to possess a westerly dip, showing the existence of a synclinal axis running between the base of New York Hill and the mines having westerly dips last named, along which, probably, the veins will, if explored in depth, be found 'in basin.' The dip at Lone Jack is about 30° west; at Allison Ranch it is about 45° west. Just below the Allison Ranch mine Wolf creek again makes a sharp turn to the left; nearly at a right angle, and then resumes its former course with the same abruptness. A mile lower down, where it strikes the Forest Springs locations, we find the Morambagua inclosed in syenitic rocks, dipping at a very low angle to the east; a dip is seen also, at a still less angle, in the Shamrock, yet further south. There is probably a saddle or anticlinal axis below the Allison Ranch mine, due to the elevation of the syenitic mass, which, it seems probable, sets in at the sharp bend in the stream, before alluded to, and where the ravine trail joins it. The stream probably runs pretty nearly in the basin of the synclinal.

"The rocks on the east side of Wolf creek, and above Forest Springs locations, dip westerly. Such is the case at Kate Hayes and with the veins on Osborn Hill. The middle branch of the creek sweeps around to the east, forms its junction with the north fork, and the veins explored there near its upper waters, as at Union Hill, the Burdette ground, Murphy vein, Lucky, and Cambridge, all dip southwest or south, conformably to the Idaho and Eureka, and at a pretty high angle. The Eureka vein, going west, faults in the Whiting ground, and, having previously become almost vertical, has, west of the fault, a northerly dip at a high angle. At the Coe ground this northerly dip is also found at an angle of about 50°. At Cincinnati Hill the vein dips southerly, in a direction exactly opposite to that of the North Star, there being a valley between the two, and a saddle or anticlinal between Cincinnati and Massachusetts Hills.

"These facts, which by a more detailed statement could be easily multiplied, seem to warrant the conclusion that the course and dip of the Grass Valley veins is especially conformable

The whole country was originally covered with magnificent forests, the different varieties of the pine predominating in the more elevated regions, and giving place to the oak in the foot-hills. As the first settlers had no interest in the soil, and felt that they were but sojourners for a time in the mines, the timber has been wastefully used, and much of it has disappeared.

The entire county is what might be termed mineral land, as distinguished from agricultural. Yet there are many sheltered valleys of rich, arable soil which have been cultivated, and amply rewarded the husbandman. The largest of these is Pema valley, lying near the westerly border of the county, and containing about 2,000 acres of good soil, which has been occupied and cultivated for many years.

SETTLEMENT.—The first settlement in what is now Nevada county was made in the summer of 1848, when the south and middle branches of the Yuba were prospected for gold for a considerable distance into the mountains, and many

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to that of the rocks, and that the streams have, in general, excavated their valleys in a like conformable manner."

In reference to the gold-bearing veins of Grass Valley, Professor Silliman says:

"The quartz veins of Grass Valley district are not generally large. Two feet is probably a full average thickness, while some of the most productive, and those which have given from the first a high reputation to this region, have not averaged over a foot, or possibly eighteen inches in thickness. There are some exceedingly rich veins, which will hardly average four inches in thickness, and which have yet been worked at a profit, while at the same time there are veins like the Eureka, which have averaged three in thickness, and the Union Hill vein over four feet. The Grass Valley veins are often, perhaps, usually imbedded in the inclosing rocks, with seldom a fluccan or clay selvage or parting, although this is sometimes found on one or both walls.

"The walls of the fissures and the contact faces of the veins are often seen to be beautifully polished and striated.

"The veins are, as a rule, highly mineralized, crystalline, and affording the most unmistakable evidence of an origin from solution in water, and afford not the least evidence of an igneous origin. Calcedonic cavities and agatized structure are very conspicuous features in many of the best characterized and most productive of the gold-bearing veins of this district. These indisputable evidences of an aqueous origin are seen in Massachusetts Hill, Ophir Hill, Allison Ranch, Kate Hayes, and Eureka.

"The metallic contents of the Grass Valley veins vary extremely; some carry but little or no visible gold or sulphurts, although the gold tenor is found in working in mill to be satisfactory, and the sulphurets appear on concentrating the sands from crushing. This is the case in the Lucky and Cambridge mines, for example. But in most cases the veins of this district abound in sulphurets, chiefly of iron, copper, and lead, the sulphureted contents varying greatly in the same vein; zinc and arsenic are found also, but more rarely, the most noted example of arsenical sulphurets being in the Norambagua and on the Houston Hill; lead abounds in the Union Hill lodes, (as galena,) and the same metal is found associated with the yellow copper in parts of the Eureka mine. The gold when visible is very commonly seen to be associated with the sulphurets; this was particularly the case in Massachusetts Hill, while Rocky Bar and in Scadden Flat, on the same vein, the gold is found sometimes in beautiful crystallized masses, binding together the quartz, and almost destitute of sulphurets. Mr. William Watt informed me that in working some seventy thousand tons of rock from Massachusetts Hill vein, the average tenor of gold was about $30; but at times this vein was almost barren, while again the gold was found in it so abundantly, especially where it was thin, that it had to be cut out with chisels. It is matter of notoriety that in the Gold Hill vein, (continuation of the vein in Massachusetts Hill,) portions of the lode were so highly charged with gold that the amount sequestered by the miners in a single year exceeded $50,000. On the other hand, in the Cambridge and Lucky mines, having a tenor of about $35 to $60 gold to the ton, the precious metal is seldom visible. In the Eureka, where the average tenor of gold in 1866 was $50 per ton, it seldom exhibited what may be called a 'specimen' of gold.

"The structure of the veins in Grass Valley varies in different portions of the district, especially in respect to the distribution of the pyrites and portions of the adjacent wall. On the Eureka Hill the veins possess a laminated structure parallel to the walls, enclosing portions of the diorite or talcose rocks, forming closures or joints in which the vein splits easily. On these surfaces of cleavage minute scales of gold may often be detected by close inspection. The sulphurets are also seen to be arranged in bands or lines parallel to the walls. In many other cases this kind of structure is found to be wholly absent, while the sulphurets and gold appear to follow no regular mode of distribution. In a few mines the rich deposits were found in the gravel bars and along the margins of those streams. Two or three parties remained in their camps over winter, but the most of the adventurers returned to the valleys or to San Francisco in the fall. The next season, when the news of the discoveries brought a rush of gold-seekers from the eastern States, the lower portion of the county, and as far up as Nevada City, was explored by prospectors. One or two companies of overland immigrants that crossed the mountains by the Truckee route stopped near Rough and Ready and remained there during the winter of 1849–'50. Another company of immigrants stopped in Grass Valley, and others who had found rich claims, including two or three families, spent the winter in the basin of Nevada. Mining, which commenced along the running streams, was gradually extended to the dry gulches and flats, and thence into the hills, thus greatly enlarging the known mining area.

Enough prospecting had been done in the summer and fall of 1849 to prove the surface diggings to be incredibly rich, individuals in some cases having taken

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sulphurets are arranged very distinctly in bands or zones, parallel to the walls, forming 'ribbon quartz.' This is especially distinct in the Norambagua, where, as before mentioned, the sulphurets are arsenical, and the gold very finely disseminated.

"The average tenor of the gold in the Grass Valley veins is believed to be considerably in excess of what is found in most other portions of California. In Allison Ranch, Massachusetts Hill, Rocky Bar, Ophir Hill, and Eureka, this average has probably reached $50 to the ton. In many other mines it has been considerably less, but, on the whole, $30 may not be far from the general average tenor of the whole district, meaning, of course, the amount actually saved by milling operations.

"The loss of gold is very various, but is probably nearly always greater than owners are willing to confess, if indeed they know, which is doubtful. It is certain, in one well-known mine, my own samples of quartz sands, and sulphurets from 'pans,' assayed respectively $23 and $57 per ton—a result which was later confirmed by the researches of another very competent mining engineer, quite independently. In other cases, as at Eureka and Norambagua, my own researches show the loss in the tailings to be very small, not exceeding $7 to the ton in the latter, and less than that in the former.

"The gold in many of the Grass Valley mines is very easily worked, being clean, angular, and not very small, hence it is readily entangled in the fibre of blankets, together with a considerable portion of sulphurets, naturally leading to the method most commonly in use in Grass valley for treatment of the gold ores."

The same authority refers as follows to the Grass Valley method of amalgamation:

"What may properly be called the 'Grass Valley mode,' consists in the use of heavy stamps, 700 or 1,000 pounds, crushing usually two tons, sometimes two and a half tons of ore each in 24 hours through screens not exceeding No. 6, rarely so fine. Amalgamating in battery and copper aprons are usually united. In some mills mercurial riffles are placed in front of the discharge, but more commonly the whole body of crushed stuff is led at once over blankets, which are washed out every few minutes into tanks, where the free gold and sulphurets are allowed to collect preparatory to being passed through the 'Attwood amalgamators.' These simple machines are designed to bring the gold into thorough contact with mercury contained in little vats, sunk in the surface of an inclined table, over which the stuff is fed to the vats in a regulated manner by a stream of water, while iron blades slowly revolve in the vats to cause a mixture of the sands and quicksilver. By this apparatus, at the Eureka mill, 90 per cent. of all the gold is obtained which is saved from the ore. Beyond the amalgamators the sands are carried over amalgamated copper sluices, and are put through various ore-saving processes, with a view especially to concentrating the sulphurets. These processes vary much in different mines. In some mills, especially the Ophir, much more elaborate mechanical apparatus has lately been introduced, with what results still remains to be seen. It is certain that if the method of treatment just sketched seems imperfect, (as it undoubtedly is,) it is the method which has hitherto yielded the large returns of gold for which Grass valley has obtained its well-deserved renown. As the development of the district goes forward, cases will occur of veins containing gold in a state of very fine division, to which other methods of treatment must be applied. Such examples indeed already exist, and the problems which they offer will be met by the use of other systems of amalgamation, or by suitable modifications of the existing system.

"VALUE OF THE SULPHURETS.—The sulphurets occurring in the Grass Valley district are usually rich in gold—some of them remarkably so. In quantity they probably do not on an average amount to over one per cent. of the mass of the ores, although in certain mines they are found more abundantly. For a long time there was no better mode known of treating them than the wasteful one of grinding them in pans and amalgamating. In this way rarely was 50 per cent. of the gold value saved. After many abortive efforts, at length complete success has been met with in the use of Plattner's chlorination process. Mr. Deetken, out thousands of dollars in a few days, and the fame of the mines reaching other parts of the State, the hills and ravines of the county were overrun with eager prospectors in the spring and summer of 1850. During that season settlements were made and mining commenced in every part of the county, except what is now Meadow Lake township, while the towns of Nevada, Grass Valley, and Rough and Ready each became the centre of a large mining population. No definite estimate can be made of the gold product of the county in 1850; but it must have been large, for there were not less than four or five thousand men engaged in the mines. The claims were extraordinarily rich, and a considerable proportion of the miners returned to their former homes with what they considered snug fortunes, of from $5,000 to $10,000 each, as the result of their summer's work. Never were fortunes more easily made by the unskilled laborer.

In the spring of 1851 the legislature passed an act for the organization of the county, the territory having previously been comprised within the limits of

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now connected with the reduction works of the Eureka mine, is entitled to the credit of having overcome the difficulties which formerly prevented the successful use of this process in Grass Valley, a more detailed description of which will be found in our notice of the Eureka mine."

In reference to the length and depth of productive ore ground, the following remarks, by Professor Silliman, are interesting:

"Of the length of the productive portion of quartz veins and the depth at which they commence to become productive, Grass Valley offers some instructive examples:

"The North Star vein, on Weimar Hill, has been proved productive on a stretch of about 1,000 feet, while the tenor of gold has gradually increased with the depth, from an average of $30 in the upper levels to nearly double that in the lower levels. The limits named are rather those of exploration than the known extent of the productive ore. In the vein on Massachusetts and Gold Hills, on the contrary, the distribution of the 'pay' has been found much more capricious, being at times extremely rich, and again, with no apparent reason, yielding scarcely the cost of milling. The Eureka mine offers the most remarkable example, however, of a steady increase from a non-paying tenor of gold near the outcrop to one of uncommon productiveness. An opinion has found advocates, and has been perhaps generally accepted by most writers on the subject of gold-bearing quartz veins, that they were richest near surface and in depth became gradually poorer. There is nothing in the nature of the case, as it seems to me, to justify such a generalization more than there is to sustain an opposite opinion. If we accept facts as a guide, we find in California that the deepest mines, for example, Hayward's Eureka, in Amador, 1,200 feet; North Star, 750 feet on the slope; Princeton, in Mariposa county, 800 feet; Eureka, (Grass Valley,) 400 feet; Allison Ranch, 525 feet, &c., as a rule have had an increasing tenor of gold. If the Allison Ranch, the Princeton mine, and some others appear to be exceptions, the answer is, we may reasonably expect the same variations of productiveness in depth which are known to exist in linear extent. The Princeton, after an excellent run of good ore, became suddenly poor, at a depth of over 600 feet, in 1865; but I am informed by Mr. Hall, the present superintendent, that the good ore came in again in a short distance. Mr. Laur, the French engineer, whose papers of California mines is often quoted, cites the Allison Ranch mine in evidence of the theory of a decreasing tenor of gold in depth, but it is in proof that since the date of Mr. Laur's visit (1862-'3) this mine has been at work on ores which have yielded over $100 value, its present suspended activity being due to causes quite unconnected with the intrinsic value of the mine. The rich 'chimneys' or productive zones of ore ground are known to be of various extent in quartz veins, from a few feet to many hundreds of feet, and it is impossible to assign any valid reason why we may not expect the same changes in a vertical direction which we find in a horizontal. As the ore-bearing ground or shoots of ore have in many, if not in most cases, a well-determined pitch off the vertical, it is self-evident that a vertical shaft or incline at right angles to the veins must, in descending, pass out of the rich into the poor ground, at certain intervals, and it is perhaps due to an ignorance of this fact that miners have abandoned sinking because they found the 'pay' suddenly cease in depth, when a short distance more would probably bring them into another zone of good ore. The experience of every gold-mining district offers examples in illustration of these remarks. In quartz veins containing a considerable amount of sulphurets, it is evident that the outcroppings should offer much better returns to mining industry than will follow after the line of atmospheric decomposition has been passed, because above this line nature has set free the gold formerly entangled in the sulphurets, leaving it available for the common modes of treatment, with the added advantage oftentimes that the particles of free gold formerly distributed through a considerable section of the vein, are found concentrated in a limited amount of ore. It is easy to reach the conclusion in such cases that the tenor of gold in the vein is less in depth, after the real average tenor is reached, while in fact it is neither greater nor less; but the metal is no longer available by common methods of treatment.

Yuba. Nevada City, then the principal town and near the centre of population, was made the county seat, where it has ever since remained. The county is divided into nine townships for local government, viz: Nevada, Grass Valley, Rough and Ready, Bridgeport, Bloomfield, Eureka, Washington, Little York, and Meadow Lake. Rough and Ready comprises the foot-hills extending across the western end of the county, from the Yuba to Bear river; Meadow Lake includes the summit extending across the eastern end; Bridgeport, Bloomfield and Eureka lie between the middle and south Yuba on the north; Little York is on the south, mostly lying between Bear river and Greenhorn creek; and between Rough and Ready and Meadow Lake are the townships of Grass Valley, Nevada and Washington, occupying the central position.

Of the early settlers but few remained permanently in the county, by far the larger proportion returning to the east, or taking up their permanent abode in other parts of California. But their places were filled by other adventurers, and the population gradually assumed a permanent character, and now numbers not far from 20,000 souls, of whom about one-third are adult males. The inhabitants derive their support either directly or indirectly from the mines, on the prosperity of which depend all other branches of business.

Placer Mining.—Placer mining properly signifies the working of the shallow deposits; but in California the term "placer" is usually applied to the deep deposits as well as the shallow diggings—hydraulic and cement mining being only branches of placer mining—and all except the quartz lodes being designated as placer mining.

The placer mines of Nevada county have been worked steadily since 1849, and have yielded an amount of treasure that, could the figures be procured, would stagger belief. The rich pockets along the margins of the streams, and the shallow diggings and ravines that required no capital and but little preliminary labor to mine successfully, have been mostly worked out, and capital and skill are now indispensable to success, yet there is but little diminution in the yield. As claims are worked out in one place new ones are opened in other localities, and although failure in any given enterprise is about as likely as success, yet the prospect of big strikes, and the hope of acquiring a fortune or a competency by one or two years of well-directed labor, are incentives that cannot fail to enlist the skill of the most energetic of the mining population.

At first, mining was confined to the gravel bars and beds of the running streams, and as these were partially exhausted, it gradually extended to the dry ravines, flats and hillsides adjacent. The rocker was the principal machine used for washing the auriferous sands and separating the gold from the lighter particles. It had been brought into use in the summer of 1848, during the first season of mining in California, though much of the gold obtained that season was separated by the Mexican method of washing the sand in wooden bowls. Sheet-iron pans are now used by the American miners for prospecting and other purposes, in place of the wooden bowls of the Mexicans. The rocker was superseded by the long-tom, by means of which a larger amount of earth and gravel could be washed; and the long-tom in its turn gave place to the sluice. This was a most important improvement, and enabled miners to work many claims that would not pay with the rocker and long-tom.*

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* Professor Silliman, in a report on the property of the Eureka Ditch Company, says of the sources to which the gold in California is referable:

"The original source from whence all the gold of California has been derived is undoubtedly the veins of gold-bearing quartz which occur so abundantly in all the slates and metamorphic rock of the western slopes of the Sierras within the areas known as the gold regions. But this original or great source of the precious metal is historically secondary to the shallow and deep digging or placers, in the former of which gold was first discovered, and which during the early years of California history furnished nearly the whole of the metal sent into commerce. That the placers were derived from the degradation or breaking up of the auriferous veins and the distribution of the detritus thus formed by the agency of running water

Ditches at length were constructed to bring the water over the hills, and as the miners were compelled to leave the flats and ravines and take to the deeper diggings, the process of shovelling the earth into the sluices became unprofitable, and the practice of ground-sluicing came into use. By this process the surface-soil, being loosened up or thrown into a trench cut in the bed rock, was washed away by a stream of water, leaving only the heavy gravel at the bottom to be shovelled into the sluices. Ground-sluicing was carried on extensively in this

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and ice does not admit of a question. It appears, also, to be pretty conclusively proved that the gold-bearing gravel is of two distinct epochs, both geologically very modern, but the later period distinctly separated in time from the earlier, and its materials derived chiefly from the breaking up and redistribution of the older or deep placers. These appear to be distinctly referable to a river system different from that which now exists, flowing at a higher level, or over a less elevated continental mass, and with more power, but generally in the direction of the main valleys of the present system. It was pretty early discovered that very extensive and valuable deposits of auriferous gravel lay at levels far above the present course of the streams, and that to wash these deposits required the adoption of new methods adapted to meet the case. Hence came the so-called hydraulic process, which, although in use now for more than ten years, has yet made barely more than a commencement upon the great mass of deep-lying auriferous shingle which remains to be treated by this method of gold washing.

"Finally comes the era of quartz mining in depth, the successful prosecution of which demanded more skill and capital, as well as cheaper labor and better machinery, than the early days of California furnished. In this man undertakes to do for himself by the use of his own skill what in an earlier age nature had done for him on a grand scale, in breaking up the matrix of the precious metal, commencing at the fountain head of the stream of gold.

"I propose at present to consider with some detail the second of the great sources of gold productions, viz: deep-lying placers. The character of these deposits is well illustrated by a description of the ground between the south and middle forks of the Yuba river, in Nevada county, where this description of gold deposit is well exposed in consequence of the considerable amount of mining work which has been performed there, the whole of this ground being controlled by the waters of the Middle Yuba Canal Company and of the Eureka Lake Water Company.

"THE DEEP PLACERS OF THE YUBA.—The Yuba is an affluent of the Feather river, which it joins at Marysville on its way to its junction with the Sacramento. The south and middle forks of the Yuba river unite with the North Yuba, the course of which is nearly at right angles to these two branches, whose mean course is west about 13° south, (magnetic,) the Feather river running about north and south.

"The ridge of land embraced between the south and middle forks of the Yuba is from six to eight miles in width, and to the limits of the auriferous gravel, as thus far explored, about 30 miles, forming an area of about 200 square miles. The elevation of this ridge above the sea is, at its western extremity, near French Corral, about 1,500 feet, from whence it gradually rises into the high Sierras, the Yuba Gap Pass being 4,570 feet above the sea, and the Downieville Buttes about 6,840 feet. This Mesopotamia is cut up by ravines descending from a central axis both ways into the valleys of the two rivers forming 'gulches' with steep sides, often beautifully wooded. The more elevated portions of the land are covered by a heavy bed of volcanic ashes and breccia, which evidently at an earlier day formed a continuous sheet over not only the tongue of land under consideration, but over the adjacent region, as is conspicuously seen in the sections afforded by the various rivers This mass of volcanic ashes contains numerous angular fragments of cellular lava, trachyte, basalt, porphyry, and volcanic mineral aggregates quite foreign to the general geology of the country. Its thickness varies with the topography and drainage of the surface, but it forms the summits of all the hills above a certain horizon, and in places reaches an elevation of from 2,000 to 3,000 feet above the level of the rivers. Below Columbia the denudation of the surface has removed the volcanic matter, leaving the auriferous gravel exposed as the upper surface. This volcanic deposit receives from the miners the general name of 'cement,' a term it well deserves from its compact and tenacious character, much resembling pozzolana or Roman cement.

"The auriferous gravel varies in thickness from 80 to 100 feet, where it has been exposed to denudation, to 250 feet or more where it is protected from such action. Probably 150 feet is not an over-statement for its average thickness in the marginal portions, where it has been exposed by working the deep diggings or hydraulic claims. This vast gravel bed is composed of rounded masses of quartz, greenstone, and all the metamorphic rocks which are found in the high Sierras.

"It is often locally stratified, but I could find no evidence of any continuity in its beddings. The lower portions are composed of larger boulders than the upper as a general rule, but this does not exclude the occasional presence of huge boulders in the central and upper portions. In a fresh fracture of the whole thickness of these deposits, such as may be seen daily in the 'claims,' which are being actively worked, a striking contrast of color is seen between the country in 1851 and 1852, the use of the sluice proper at that time being well understood, and having in a great measure superceded other methods. With most of the mining improvements there were no especial inventions, but the different appliances came into use gradually as they were needed by the changing character of mining, and may be considered as the result of the combined skill and ingenuity of the mining population. William Elwell put up and used the first sluice at Nevada City, in February or March, 1850, but he does not claim it as

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lower and upper portions of the gravel mass, consequent on the percolation of atmospheric waters and air, oxidizing the iron resulting from the decomposition of pyrites, and staining the gravel of a lively red and yellow color in waving lines and bands, contrasting boldly with the blue color of the unoxidized portions. A close examination of the blue colored portion of the gravel shows it to be highly impregnated with sulphuret of iron, (iron pyrites,) forming, in fact, the chief cementing material which holds the pebbles in a mass as firm as conglomerate, requiring the force of gunpowder to break it up.

"In the upper portions of these beds are frequent isolated patches, often of considerable extent, composed of fine sand, clearly showing water lines, curved, sloping, or horizontal, but never for any distance regular, and in these portions occur frequently large quantities of lignite, or fossil wood, little changed from its original condition, but blackened to the color of coal and flat with pressure. Among these remains are logs similar in appearance to the Manzanita, now growing abundantly on the hills of auriferous gravel. Some of these, which I measured, were 15 to 18 inches in diameter, and 10 to 15 feet in length. Occasionally the mass of this ancient driftwood accumulated in these eddies of the current, where they were deposited with the fine sands, amount almost to a continuous bed of lignite.

"Wedge-shaped and lenticular masses of tough yellow and whitish clay also occur in the ancient drift, replacing the gravel and affording, by their resisting power, a great impediment to the operations of mining.

"The 'slacking down,' or disintegration which a few months' exposure of the hard gravel 'cement' produces, is due mainly, if not entirely, to the decomposition of the associated pyrites before noted. It is remarkable how large a part of the smoothed and beautifully rounded stones, even those of large size, undergo a similar slacking by atmospheric action, even in a very brief period of time, rendering it almost impossible to preserve specimens of the gravelly concrete unless they are protected by varnish. The most unyielding of the 'cement' masses are sometimes left over one season by the miners, exposed to the air and frosts, to secure the benefits of this disintegration, without which but little of the contained gold can be obtained.

"The gold is disseminated throughout the entire mass of this great gravel deposit, not uniformly in value, but always in greater quantity near its base or on the bed rock. The upper half of the deposit is found to be always less in value than the lower part, sometimes so poor that it would be unprofitable working by itself, but inasmuch as there is no practicable mode of working the under stratum, without first moving the upper portion, in practice the whole is worked.

"The gold rarely occurs in large masses in this ancient gravel. Often on the polished and very smooth surfaces of the 'bed rock' and of the superincumbent masses of gravel when freshly raised from their long resting place, the scales of brilliant yellow metal are beautifully conspicuous. These are frequently inlaid so firmly upon the hard granite floor of the ancient river or glacier as to resemble hard stone mosaics. In fact the whole surface of the bed rock requires to be worked over by the pick to secure the gold entangled in its surface, to a depth, when soft, (as of mica or chloritic slate or gneiss,) of several inches. * * *

"The bed rock, as it is significantly termed by the miners, shows everywhere, when freshly exposed, the most conspicuous evidence of aqueous or glacial action. The course and direction of the motion which has left its traces everywhere is plainly discernable. * * *

"The 'bed rock' varies of course in different portions of the area now under consideration, being either granite, gneiss, greenstone, or shale. In the granite are observed numerous minute quartz veins pursuing a course parallel to each other often for hundreds of feet without interruption.

"In the 'American claim,' at San Juan, the granite is succeeded on the west by a large jointed blue siliceous shale of the same strike with the main joints of the granite. This latter rock is covered by numerous very large boulders of metamorphic conglomerate, of which no traces are seen in place.

"The course of the ancient current, where I had an opportunity of measuring it, appears to have been about 20° to 25° west of north, (magnetic,) which it will be observed is nearly at right angles to the mean course of the middle and south forks of the Yuba river; but it is not far from parallelism with the axis of the Sacramento river valley, or of the great valley between the coast range and the Sierra Nevada. I have noted the same general direction of the scratches elsewhere in the great gold region, but additional observations are required to justify any comprehensive generalization. This much appears clearly shown, however, by the present state of our knowledge on this subject, viz: that the spread of the ancient gold-an invention—some one having suggested the idea to him. A. Chabot and M. F. Hoit used them soon after, and greatly improved the arrangement of the riffles and the method of working.†

Hydraulic Mining.—The hydraulic system came into use in Nevada county in 1853, and enabled miners to work with profit a vast amount of auriferous ground that would never have paid by the old process of sluicing. About April, 1852, A. Chabot, mining near Nevada City, used a hose of some thirty-five or forty feet in length, through which the water was conducted from the top of the bank to the bottom of his diggings. There was no pipe or nozzle at the end, but still it was found to be a great saving in sluicing off the earth and gravel that had been picked down, and also a convenience in cleaning up the bed-rock. So far as known the hose was not used that season in any other claims, and it does not appear that Chabot discovered the great advantage that would result by directing the stream of water against the bank. This discovery was made by E. E. Matterson a year later. In April, 1853, Matterson and his partners, who were working a claim on American Hill, rigged up a hose, attached a nozzle at the end, and directing it against the bank, as water is thrown upon a building by a fire engine, found that a small stream of water would do the work of a hundred men in excavating earth. Very soon after this the hydraulic was adopted by the miners throughout the county wherever water and a sufficient fall could be procured. Successive improvements have been made in hydraulic mining, until the appliances now in use but little resemble those of 1853; but the principle is the same, and to Matterson is due the credit of the important discovery.

The water is usually conducted into the diggings through large iron pipes, at the end of which the hose is attached, and the water having a high fall is com-

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bearing gravel was produced by a cause greatly more elevated than the existing river system, or, which is more probable, at a time when the continent was less elevated than at present,* and moving in a direction conformable to the course of the valleys of the Sacramento and San Joaquin. We find it impossible to admit the existing river system as a cause adequate to the spreading of such vast masses of rounded materials; the facts plainly point to a much greater volume of water than any now flowing in the valley. The section already given illustrates perfectly the relations of the present river system to the more ancient one whose grand effects are chronicled in the bed rock and its vast superincumbent mass of auriferous gravel. It serves also to illustrate the process now in progress by which the existing river system derived its gold-bearing sands, in great part at least, from the cutting away and secondary distribution of these ancient placers.

"Those who have had the opportunity of visiting other portions of the great gold region of California than that now under consideration, will at once recognize the local character of the details given as perfectly consistent with the general phenomena of the ancient placers as observed elsewhere; while at the same time great differences are found in many of the details. Thus in Calaveras and Tuolumne counties, 80 or 100 miles further south, the volcanic matter capping the auriferous gravel is found in the form of basaltic columns, beneath which occur the same phenomena already described. Here the wood contained in the gravel beds is beautifully agatized, or converted into semi-opal, as is also the case at Nevada City, Placerville, and elsewhere, associated with beautiful impressions of leaves of plants and trees similar in appearance to those now found in this region.

"This general description of the deep-lying placers of the Yuba might be greatly extndede from my notes, but enough has probably been said to convey the impression that the phenomena here described are on a grand and comprehensive scale, and referable to a general cause long anterior in date to the existing river system—a cause which has been sufficient to break down and transport the gold-bearing veins of the Sierras, with their associating metamorphic rocks, thus laying up in store for human use deposits of the precious metal in amount on a scale far beyond the notions generally prevailing of the nature of placer deposits."

*It is the opinion of geologists that subsequent to the tertiary period was the time when the main valleys of the continent were excavated by erosion. It was probably in this epoch that the deep-lying auriferous gravel was produced from the degradation of the metamorphic schists and quartz veins of the sierras by the joint action of water and of glaciers.

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† The sluice is undoubtedly the most essential of any one contrivance for saving gold, and is used in all placer mining operations. It can hardly be called a machine; but is simply a board flume, on the bottom of which are fixed blocks of wood, rounded stones, or riffles, with quicksilver to catch and detain the gold, while the earth and gravel is carried down by the current.

pressed and forced through an aperture of one and a half to two inches in diameter. The pipes are made of heavy sheet iron, and the hose of stout canvas usually double thickness. Where the pressure is great, the hose are still further strengthened by a net-work of strong cord. In some of the larger mining operations five or six streams of water are kept playing upon the bank, undermining the ground and melting away the hills at an incredible rate. In this manner acres of ground, frequently 100 to 200 feet deep, are washed away in a single season, and the bed-rock left bare. The water shoots from the nozzle with tremendous force, and miners frequently direct the stream against huge boulders to roll them out of their way. The hydraulic is the most effectual method ever yet devised for excavating large quantities of earth, and the process was employed to some extent in 1866, by the Central Pacific Railroad Company in cutting through the deep hills near Dutch Flat.

The American miners, except those engaged in quartz, are chiefly working the deep hill diggings by the hydraulic, the shallow flats and ravines, as a general thing, being abandoned to the Chinese. In most cases, the cost of opening the deep claims is heavy, requiring considerable capital and the nerve to invest it, or the aggregated labor of a number of miners who are content to work, perhaps for years, in the hope of an eventual reward. In too many cases their labor and perseverance has come to naught. The richest deposits are found on the bed-rock in basins or in the channels of ancient streams, and to reach these tunnels have to be run in solid rock, varying in length from a few hundred to several thousand feet in order to drain the ground and get an outlet for sluicing. Wherever practicable, a shaft is first sunk to prospect the ground and ascertain the position of the basin or channel, so that the tunnel in coming in shall be below the auriferous deposit. But this cannot always be done, and expensive tunnels are sometimes found to be too high to work the ground, and a lower one must be run or the claim abandoned. The tunnel serves the double purpose of draining the ground and a sluiceway, and the mining usually commences from a shaft sunk from the surface to the head of the tunnel.

The most important centre of hyraulic mining in this county is at North San Juan, in Bridgeport township, and a brief statement of the operations of some of the companies there will give an idea of the scale on which this branch of mining is conducted. The Eureka Company, whose claims were on San Juan Hill, commenced a tunnel in August, 1855, to reach the inner basin. The tunnel was completed in October, 1860, at a cost of $84,000, in actual assessments, and the cost incurred before a dividend was declared was $142,000. During the existence of the company the average number of men employed daily was 25, and the total yield of the claims $530,000. The claims known as the Deadman Cut, which were worked out in 1859, yielded $156,307, at a cost of $71,433. The claims of McKeeley & Company, on Manzanita Hill, were worked from 1855 to 1864, yielding $368,932, and paying its owners in dividends $126,660. The claims above mentioned have been worked out, but there are other companies still carrying on extensive operations in the vicinity, some of which are deriving a handsome revenue from the profits of working their claims. The tunnel of the American Company is 1,800 feet in length, having been run much of the distance through blasting rock. This company has adopted all the improvements in hydraulic mining. They have a mill with eight stamps for crushing cement, and their sluice boxes extend from Manzanita Hill to the middle Yuba, a distance of nearly a mile, where they have pans for grinding the sand. The company usually employ 25 men, use 500 inches of water, and the claims yield from $10,000 to $15,000 a month. It will require three or four years longer to work out the claims. The tunnel of the Yuba Company is 1,500 feet in length, and was completed last spring after eleven years' labor. This company uses 400 inches of water, and has ground enough to last ten years. The tunnel of the Star Company is 1,400 feet in length, that of the Golden

Gate Company 800 feet, the Wyoming Company 1,000 feet, the Knickerbocker 2,000 feet, the Badger 700 feet, and that of the Gold Bluff Company 1,800 feet. These tunnels have been run for much of the distance through solid rock, which costs from $30 to $50 a foot.

BIRCHVILLE, situated four miles west of North San Juan, has also been a prosperous locality for hydraulic mining. The Irish claims were worked by means of drifting for a number of years, and paid largely. Water was furnished by the Shady creek and Grizzly ditches, but in such limited quantities that little progress was made in hydraulic mining until 1857, when the Middle Yuba Canal Company extended their ditch to Birchville, and furnished water in abundance. In 1859 four bed-rock tunnels were projected, and completed in 1864, at an aggregate cost of $120,000. These tunnels drain the upper portion of the channel; the lower portion will be drained by another tunnel 2,400 feet in length, now in course of construction, by means of which a large extent of valuable mining ground will be worked. The gross yield and net profits of the claims of five of the leading companies at Birchville, for 1866, were as follows, in round numbers:

	Gross proceeds.	Net profits.
Irish American Company	$180,000	$133,000
San Joaquin Company	134,000	68,500
Don Jose Company	100,000	72,000
Granite Tunnel Company	82,000	24,000
Kennebec and American Company	85,000	30,000

The years 1865 and 1866 may be regarded as the harvest time for the Birchville miners, as they had previously been at heavy expense in opening their ground, which is now nearly worked out. Many of the owners in the above claims are appropriating a large share of their profits to running the new tunnel.

FRENCH CORRAL is situated at the lower terminus of the auriferous gravel range that is found between the Middle and South Yuba rivers. The ravines and flats proved to be rich, and attracted thither a considerable number of miners, at seasons of the year when water could be had to work the claims. The hill diggings were discovered in 1853, and ditches were constructed from Shady creek to bring in water to work them. Tunnels and cuts were run into the hills wherever fall could be obtained, the ditches were enlarged, and profitable mining soon followed. Subsequently deeper tunnels were run, in order to reach the bottom of the deposit, which was found to be from 100 to 200 feet below the surface. The total cost of the various cuts and tunnels of the district cannot be less than a quarter of a million dollars, and the amount of gold taken out must be several millions. A large extent of valuable mining ground remains to be worked. In addition to the hydraulic mines, there is a broad, deep stratum of blue cement gravel which is rich in gold. This will have to be worked by mill process, as is already being successfully done in other parts of the county, and will give work to several mills for years.*

MOORE'S FLAT, situated on the slope of the hill south of the Middle Yuba, in Eureka township, is another important centre of hydraulic mining. Several thousand acres of ground, averaging 100 feet in depth from the surface to the bed-rock, have been sluiced off, giving employment to several hundred miners for the past 15 years. Of late the claims have been bought up by a few large companies, who are carrying on operations upon an extensive scale, and generally with success. At Wolsey's Flat, a mile below Moore's, are some of the deepest diggings in the county, the bank in one place being over 200 feet in height. Orleans flat, two miles above Moore's, was formerly an important mining locality, and at one time had a population of 600 or 800; but the diggings being comparatively shallow have been entirely worked out, and the town is now deserted.

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* For a more detailed account of this district see article on ditches.

At North Bloomfield and Columbia Hill, in Bloomfield township, at Gopher Hill and Scotch Flat, in Nevada township, at Quaker Hill, in Little York, and many other places in the county, hydraulic mining is carried on quite extensively.

The amount of capital invested in hydraulic and placer mining in the county, including the cost of opening the claims, iron pipes, flumes and sluices, and various other implements and improvements, is estimated at $1,500,000. These mines give employment to about 2,000 men including several hundred Chinese, and yield annually not far from $3,500,000—say $1,750 to each man. Three dollars a day is the usual wages paid to miners; but the water bills and other expenses absorb a large portion of the gross product, so that the net yield to the miners, if the whole could be averaged, would be but little in excess of their wages. Of course, some of the claims afford large profits, while others scarcely yield sufficient to pay water bills; but the miners persevere to the extent of their means in hopes of striking better pay.

Cement Mining.—In some of the auriferous deposits found in the beds of the ancient lakes and watercourses the gravel is cemented together so compactly that considerable force is required to pulverize it, in order to save the gold by the sluicing process. For this purpose various expedients have been devised by the miners, among which is the erection of stamp mills, similar to those used in crushing quartz, and the business has become of considerable importance in this county. Little York township has taken the lead in this branch of mining. Cement mills have also been erected in Washington, Eureka, Bridgeport, Nevada, and Grass Valley townships, but mostly as adjuncts to hydraulic mining, and the yield from this source, as compared with that from other branches of mining, is small. In Little York, however, it is the leading business.

Blue cement gravel was found in many of the hill claims in Little York township as early as the summer of 1852, and in some of the claims it was so tough that it had to be blasted in order to drift it out. A very small proportion of the gold was saved by merely running it once through the sluices, and the method at first adopted was to pile up the tailings and allow them to remain some months, until the action of the elements had partially decomposed them, and then sluice them again. In this manner each lot of gravel was run through the sluices six or eight times, requiring two or three years for the operation. The Chinamen work the cement in the same manner now, and many are of the opinion that it is the most efficient and economical method; but the process is too slow for American miners.

The first stamp mill for crushing cement was built by the Massassauga Company, near the town of Little York, in the summer of 1857. This mill had no screens, but the cement was thrown into the battery, where the stamps were kept running, and carried off into the sluices by a stream of water. Of course, much of the cement was not pulverized, but the tailings, after running through the sluice, were saved for a year or more and allowed to slack, when they were run through again, and yielded nearly as much gold as on the first run. Another mill was built near Little York in the spring of 1858, which was a considerable improvement on its predecessor, and cement mills have since been erected at You Bet, Red Dog, Hunt's Hill, Gougeye, and other places in the township. The screens now used are nearly as fine as those commonly used in the quartz mills, and it has been fully determined that the finer the cement is crushed the more gold will be saved.

At the present time there are 16 cement mills in Little York township, having in all 136 stamps; two in Washington township with eight stamps, one in Eureka with eight stamps, one in Bridgeport with eight stamps, one in Nevada with 15 stamps, and one in Grass Valley, with eight stamps. These make an aggregate in the county of 22 mills, with 185 stamps. Some of these mills are kept running steadily, others are in operation only a portion of the time, and a number have been idle for a year or more in consequence of the inability of the owners to open their claims, and other causes. The amount of gravel crushed by a stamp varies from three to eight tons in 24 hours. Sometimes loose gravel is run through the mills to save the gold contained in the quartz pebbles, and which would be lost by ordinary sluicing; but much of the cement is very compact and as difficult to crush as the hardest quartz.

The cement mills are not usually provided with the appliances for amalgamating and saving the gold that are now connected with the quartz mills. Quicksilver is used in the batteries, where the most of the gold is amalgamated, and after leaving the batteries the pulp passes over galvanized copper plates and riffles filled with quicksilver, and whatever gold is not saved by this process is lost. A much-needed improvement is an effectual method of concentrating the sulphurets. These are found in considerable quantities with the cement gravel, and generally contain sufficient gold to yield a good profit when worked by the chlorination process. If machinery, not too expensive, could be devised for separating them from the mass of pulp, it would add largely to the profits of the business.

The working of the cement deposits, like other branches of mining, has had its ups and downs, but on the whole has been progressing, and the business has been increasing in importance since the first mill was erected in 1857. Almost every claim has at times paid largely, and again the receipts would fall below expenses. The gold is unevenly distributed throughout the gravel deposits, being found in great abundance wherever the position of the rock or other circumstances were such as to form riffles, and in other places insufficient to pay the cost of drifting out the gravel. Whether the business is to increase until it becomes of leading importance depends on the character of the deposits that may hereafter be opened in the ancient river channels. A vast amount of placer mining ground yet remains to be opened, and should a considerable proportion of the gravel found therein be cemented so as to require crushing, mills will be erected for the purpose; otherwise it will be worked by the more economical process of sluicing.

The capital invested in cement mining in Nevada county, including the mills, hoisting machinery, cost of opening the claims, &c., is about $400,000; number of men employed, 300; annual yield, $300,000. These figures, given in round numbers, are very nearly correct, as applied to the past three years. There are some outside expenses, which, added to the wages of the miners, will probably somewhat exceed the gross yield. Some of the cement mines have paid largely, while others have proved failures; but the failures have not been so disastrous and universal as the early quartz failures.

Extent of the Placer Mines.—The product of the placer mines of Nevada county has neither materially increased nor diminished since 1850, and though they have been worked without interruption for 19 years, the developments of that period have barely been sufficient to give us an idea of their vast extent. The shallow diggings, which were so easily worked, and afforded such large returns to the early miners, are mostly exhausted; but the deep placers, or hill diggings, in the channels of ancient streams, in many places underlying hundreds of feet of alluvial deposits and volcanic material, cannot be exhausted for a long period of time. In fact, for all practical purposes, they may be considered as inexhaustible.

The long gravel ranges, extending from the high Sierra to the foot hills, cover nearly half the surface area of the country, for the most part are auriferous, and in places are of great depth. Gold in greater or less quantities is found from the surface down, in some places sufficient to pay running expenses; but for their profits the miners mainly rely on striking rich gravel deposits in the channels of what once were running streams. These ancient channels are very numerous, and the gravel deposits therein are of the same character as those in existing streams. Many of the old channels are cut transversely by others, showing the existence of not only one, but several ancient river systems; but whether the great changes on the western slope of the mountains were produced by causes now in force, or by sudden convulsions, the facts yet brought to light are not sufficient to warrant us in forming a theory. The petrefactions, which are found plentifully in the deepest diggings, are the pine, oak, manzanita, and other varieties of wood now growing in the mountains, indicating that no great climatic or geological changes have taken place since the ancient channels were filled up. The filling up process may have been aided by volcanic action, raising the beds of rivers in places and forcing their waters into new channels. These new channels would, in time, wear deeply into the bed rock, and in this way the deep gulches, ravines, and valleys were formed. The formation of new valleys by the action of water left the old river channels filled with gravel and volcanic ashes to solidify, and become less pervious to the assaults of time than the primitive rock that walled them in. Myriads of ages have abraded and worn away the solid rock that once enclosed and towered far above the old channels; but the cement ridges, defying more stoutly the action of the elements, remain to attest their comparative indestructibility and the magnitude of nature's changes.

Thus far the old river channel has only been opened and worked at the more favorable localities, where there are biwashes, or where they have been cut by more modern streams, as is the case in the Nevada basin. The ridge between the South Yuba and Deer creeks is broken by two deep depressions, directly north of Nevada City, and a peak called Sugar Loaf Hill rises between the gaps. At this point the ridge curves to the west, but the ancient channel, which for some distance above follows the course of the ridge, continues its general southwesterly direction, and makes out into the basin. Here the overlying strata being comparatively shallow, the channel was discovered at an early day, and worked by means of drifting, or burrowing, whence it was called the "Cayote Lead." Shafts were sunk on Bourbon, Manzanita, Wet, and American Hills, and the richest deposits drifted out, but the claims were subsequently bought up by a few companies, and the ground worked from the surface down by the hydraulic. These claims yielded immensely, and the amount of gold extracted from the base of Sugar Loaf to the lower workings on American Hill, a little over a mile, is believed to have reached $7,000,000 to $8,000,000. The amount, however cannot be ascertained with any degree of accuracy. Subsequently the channel was traced northeasterly under the high ridge, and worked out for a distance of 3,000 feet by the Young America, Live-oak, Nebraska, and some other companies of less note, and the yield of gold in that distance along the channel is known, however, to have exceeded $3,000,000. The channel is nearly parallel with Deer creek, though it must have carried a much larger quantity of water, and the average fall appears to have been but little over one foot in a hundred. The same channel was opened a mile above by the Harmony Company, where the deposit was found to be equally rich; but that company was so unfortunate as to commence operations on the north side of the ridge, when the channel, at their location, sweeps round to the south side, thus largely enhancing the cost of working. After taking out $70,000 at a cost of $83,000, they suspended operations. The most of the ground has been located for a distance of eight miles up the ridge, and at two or three different places the channel has been found, and fine prospects obtained, but the operators, for the want of adequate pumping machinery, were compelled to desist. The claims of the Cold Spring Company adjoin the Harmony ground above, and still further above are the claims of the Fountain Head Company. These companies are preparing to commence operations under favorable auspices. The evidence is conclusive that the channel extends a considerable distance up the mountains, perhaps 20 or 25 miles, and there is no reason to doubt that every 1,000 feet of its length holds its million of treasure. Besides this, large quantities of gold are found in the smaller channels that were probably once tributaries of the main streams, as well as in the alluvium above. The rich hydraulic diggings at Gold Hill, Alpha, Omega, and other places, now mostly worked out, are on this range.

The most extensive placer mining field in the county, and perhaps in the State, is the ridge between the Middle and South Yuba, embracing the townships of Bridgeport, Bloomfield, and Eureka. This ridge is about 30 miles in length, and from six to eight in width, forming an area of about 200 square miles. The more elevated portion is covered by a volcanic formation; but in the lower portions, in Bloomfield and Bridgeport townships, the volcanic material has been worn away, leaving the ground in a more favorable condition for hydraulic operations, which is now being improved at North San Juan, and other places already referred to. Professor Silliman, and M. Laur, a French engineer of mines, have described this ridge, and made some curious estimates of the amount of gold contained therein. Laur estimates that the region under consideration, worked at a rate which would yield $12,000,000 of gold annually, would be exhausted only after a period of 524 years, which would give as the gold product over six thousand millions of dollars. This estimate, however, is based on the supposition that the entire gravel range is equally as rich as the claims which he examined.* The more moderate estimate of Professor Silliman gives

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* The Lake Company distributes water to several hundred workings, among which I will choose, for illustration, that of the "Eureka claim," near the little village of San Juan. In the Eureka claim, the gravel bed is 135 feet deep, or about 43 metres. The first 23 metres from the surface are a rather poor but easily washed sand; the 18 metres below are a very coarse gravel, richer, but quite difficult to disintegrate. The working, therefore, is carried on under conditions of some difficulty.

The working district has been controlled by a "bed rock tunnel" or drain-gallery, cut for a great distance into very hard granite, at the rate of 40 francs the running foot, (about 700 francs a metre,) giving a total cost of 140,000 francs. The claim is still in full activity.

The working is carried on by four *jets d'eau*, discharging together about 25,000 litres of water a minute under a pressure of 43 metres. These *jets d'eau* break up the gravel against which they are directed, and the current carries off the mud and stones into the sluices in the drain-gallery, where the gold is deposited.

Four men are sufficient to direct this work, which is carried on for two weeks, say ten working days of eight hours each. At the expiration of this time the washing down of fresh earth is stopped, the sluices are washed, and the gold is taken up.

During this period of ten days 28,080 cubic metres of gravel are worked over, removing the auriferous deposit over a superficies of 620 square metres. The charges for working are as follows:

	Francs.
Expenses of water	5,000
Manual labor	864
Sundries, about	500
Total	6,364

The gold taken from the sluices at the end of this period brings an average of 30,000 francs. This yield increases to 80,000 and 100,000 francs, when the working has been confined exclusively to the lower portions of the gravel.

These results show the value of gold extracted from one of these California alluvial mines; they bring out especially the great progress on working and the small amount of human labor in this new method of washing. In fact, estimating the cost of a miner's wages at the uniform rate of 20 francs, the expense of manual labor necessary for working one cubic metre of gravel by the several methods hitherto employed is as follows, viz:

		Fr.	*Cent's.*
By the pan	about	75	00
By the rocker	"	20	60
By the "long tom"	"	5	00
By the sluice	"	1	71
By the new method (hydraulic washing)	"	0	28

Let us suppose the workings now actually open on the ridge of land which I have taken the area of the places where gravel deposits have been worked on this ridge as equal to fifteen square miles, and its probable yield in gold is estimated at $544,610,000. In this estimate the gravel deposits underlying the volcanic formations were not taken into account. These are known in many places to be rich, but in most cases can only be reached at considerable cost.* The Mount Zion Company has been engaged for eleven years in an enterprise to open the ground under the cement ridge near Snow Point. They commenced operations on the South Yuba side and run a tunnel to the centre of the hill, where they found rich gravel; but the tunnel proved to be higher than the bed of the channel, and was of no service in working the ground. They then started another tunnel on a lower level, which, after several years' labor, is now nearly completed. The Kentucky Company, encouraged by the prospects obtained in the claims of the Mount Zion Company, commenced a vertical shaft last spring, near Snow Point, with the view of sinking to the bed rock. After sinking 106 feet through lava cement, they reached the alluvial deposit, and the enterprise is still in progress. The cost, and length of time required to realize returns, have a tendency to discourage miners from embarking in such undertakings, though they may feel certain that the gold is there.

THE CHALK MOUNTAIN RANGE, lying mostly between Bear river and Greenhorn creek, on the southerly border of the county, is another mining field of immense prospective value. The average elevation of the ridge is somewhat greater than either of the others in the county, and the higher portion is covered with lava and basaltic rocks. At the southwesterly extremity, near Red Dog and You Bet, and along the margins of the ridge, where the volcanic covering has been worn away, the auriferous gravel has been worked by the hydraulic, and in most places yielded excellent returns; but by far the larger portion of the ground will have

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as an example, to be replaced by one hundred areas equal in importance to the Eureka claim. These one hundred hypothetical districts would be precisely equivalent to all those now existing; for, according to the preceding indications, it would absorb all the water brought by the Lake Company, as does this. The richness of the gravel, taken in its total mass, being assumed to be nearly uninterrupted, the yield of gold would be in both cases sensibly the same.

Now, the actual working of the Eureka after a year, equivalent to 200 days' effective labor, brings a value in gold of 3,000×200=600,000 francs. After an equal period the one hundred openings supposed would have brought in 60,000,000 francs, and would have removed the auriferous deposit over an extent of 1,240,000 square metres.

But the total superficies of the deposit being at least 650,000,000 square metres, we see that this total gold-producing area, yielding $60,000,000 of gold annually, would be exhausted only after a period of 524 years.

The placer to which the preceding indications refer is certainly one of those where the production of gold is most perfectly organized and most active; but its extent, which is 650 square kilometres, is unimportant in connection with the total extent of the analogous deposits which are found scattered over the superficies of 19,000 square kilometres which forms the auriferous zone of California. An increase of the area worked over, and a consequent increase of production from this class of deposits, is possible everywhere, within limits, in the gold regions of California.—*Mémoire de la Production des Métaux Précieux en Californie. Rapport à son Excellence M. le Ministre des Travaux Publics. Par P. Laur, Ingénieur au Corps Impérial des Mines. Paris,* 1862. 8vo. pp. 132.

* Mr. Black estimates the length of the mining claims of the present, supplied with water by the Middle Yuba Canal Company, at five miles, with an average width of 350 yards, and an average depth of 40 yards, making a quantity of 123,000,000 of cubic yards of auriferous gravel. He also estimates that eight per cent. of this quantity has been worked away in the past 12 years, leaving 113,000,000 of cubic yards which remain for future operations. At an average of 34 cents of gold to the cubic yard, (the average of the Yuba region appears to be from 30 cents to 45 cents per cubic yard, saved in the hydraulic process,) the volume of auriferous gravel here estimated would yield over $38,000,000. But the total area of the various places where gravel deposits have been worked on this ridge is estimated by Mr. Black as equal to 15 square miles, all of which, and much more, is controlled by the water of the Eureka Lake Company, or of the Middle Yuba canal. If this area is estimated at an average of 40 yards in depth, (it varies from 60 to 200 and 250 feet in depth,) we shall have 1,815,366,000 cubic yards of gravel, and if this be estimated to yield only 30 cents per yard we reach the grand aggregate of $544,610,000 as its probable yield of gold.—*Professor Silliman's Report on the Deep-lying Placers, March,* 1865.

to be worked by drifting, either by means of deep shafts or extensive tunnels. The ridge extends nearly to the summit of the Sierra, but is divided by the valley of Bear river, 15 miles above Red Dog, which cuts through it nearly at right angles, making a deep depression, the hills rising to the height of 600 or 800 feet on each side of the valley. Three miles below Bear valley, on the south-easterly side, the deep gorge of Steep Hollow has cut down through the volcanic and gravel formations to the bed rock, showing the thickness of the overlying mass to be at least a thousand feet. The Chalk Mountain Blue Gravel Company made extensive locations on the ridge in the spring of 1866, and has since been engaged in making explorations under the superintendence of S. N. Stranahan. An incline shaft was sunk at the southwesterly end of the company's ground, into the body of the mountain, going down on the red gravel, under the pipe-clay. Their explorations revealed a well-defined ancient river channel, the rim rock rising to a considerable height on each side. The course of the stream was nearly southwest, and evidences of an old river channel have been found at Steep Hollow and Bear valley, which is believed to be the same. For the past six months a mining company has been engaged in sinking a vertical shaft at Bear valley, and at a depth of a little over a hundred feet they struck a deposit of gravel and boulders, evidently made by a running stream, having a southwesterly course. Whenever explorations have been made in this region, the different strata are found in the following order: The blue cement gravel, in which the gold is very unevenly distributed, is found only in the channels of the ancient streams. Over this is a deep bed of loose, gold-bearing gravel, of a reddish color, and this is covered by a deep layer of pipe-clay. This is what is termed the hydraulic ground, the principal "pay" being in the red gravel. At higher elevations on the ridge, the lower section is exactly the same, but with two additional stratifications. Above the pipe-clay is a deep deposit of conglomerate boulders, and above this a bed of lava or basaltic rocks. The bed rock is uneven, and in many places rises into the pipe-clay and cuts off the red gravel; but wherever this deposit is found, and the overlying mass is not too deep, it invariably pays for hydraulicing. There is a vast quantity of this ground to be worked, but to open a claim usually requires the labor of several miners for two or three years. Deep cuts have to be made in the bed rock, or long tunnels run, to obtain sufficient fall for a sluiceway to run off the earth.

Another gravel range dividing the waters of Greenhorn and Deer creeks, passing Nevada on the north and Grass Valley on the south, extends westerly through the county to the foot-hills, terminating at Smartsville, in Yuba county, where some of the best mines in the State are situated. The elevation of this ridge is less than either of the others described, and the ground in many places has been worked successfully by the hydraulic. At the Alta shaft, sunk on this range near Grass Valley, an immensely rich deposit of gravel was discovered in the bed of an ancient stream, which afforded large profits to the owners of the claim. It is believed by some that a continuous channel extends the length of the ridge from which came the rich surface diggings at Rough and Ready that were worked out at an early day. Much of this range will not pay for working with the present appliances for mining, and at rates now charged for water; but with further improvements in the art of mining, and perhaps the cheapening of water and the cost of living, it is probable that the most of it will eventually be worked.

No estimate approaching to accuracy can be made of the amount of gold contained in the placer mines of this county, and which yet may be brought forth for the benefit of the civilized world. To say that it is enough to pay off the national debt would be a moderate estimate, and it is not improbable that in some of these deep placers, deposits of gold may yet be found in such quantities as will materially diminish the value of the metal. But to extract it from the vast accumulations of debris in which it is hidden will cost thousands of miners centuries of toil. Some of the workers, more lucky than their fellows, will strike valuable deposits, and become suddenly enriched, while the majority, as has always been the case, will toil on in poverty. The hope of rich strikes is the great incentive to the miner to persevere, but the risk, which is always considerable in mining operations, even when the best judgment is exercised, has a tendency to deter capital from embarking in the business.

QUARTZ MINING.—In the mining and working of gold-bearing quartz, as in most other branches of mining, Nevada county has taken the lead, and is far in advance of other sections of the gold region. It was not until the spring of 1850, when the placer mines had been worked two seasons, that attention was directed to the quartz veins as the matrix in which the gold was originally formed, and the sources from which that found in the surface diggings was derived. The early settlers, and those who first rushed to California on the announcement of the discovery of gold, had no knowledge of vein mining, and were too much absorbed in collecting the precious particles which were found mixed with the gravel on the bars and in the beds of the streams to give any attention to the sources whence they came. The discovery of gold imbedded in quartz pebbles led to an examination of the lodes, and some quartz locations were made early in the spring of 1850.

The first quartz location in Nevada county, of which we now have any information, was made at Gold Hill, near Grass Valley. This was in June, 1850. Quartz was discovered at Massachusetts Hill soon after, and in October of the same year the Gold Tunnel lode was located at Nevada. The latter was discovered by four young men from Boston, while engaged in their first day's work at mining. A few other locations were made the same season, both at Grass Valley and Nevada, but the three above named have become especially famous for their immense yield of gold, amounting in the aggregate to nearly double the present assessed property valuation of the county. The first mill in the county was erected by two Germans, at Boston ravine, near Grass Valley, in the winter of 1850–'51. It was a rude affair, and of course was a failure.

In 1851 there was a great quartz excitement in this county. The shallow surface diggings were beginning to show signs of exhaustion, or at least were not so readily found as in the preceding years, and prospectors were running over the hills in search of lodes. Numerous mills were projected, and during the fall and winter eight or ten were erected at Nevada, and as many more at Grass Valley. All the Nevada mills, with the exception of the Gold Tunnel, and the most of those at Grass Valley, proved disastrous failures, and in 1853 the quartz interest was completely prostrated. With our present experience in quartz mining, we can readily perceive the causes of the early failures in the business. The mills were erected at enormous expense, in many cases the projectors paying an extortionate interest for money; they had been deceived by professed assayers, or had deceived themselves as to the amount of gold contained in the quartz; the appliances for amalgamating were of the rudest description, and there were no miners in the county who knew how to open and work a quartz vein.

At Grass Valley, where some eastern and English capital had been invested, a number of companies continued operations, several mills were kept running, and the business slowly revived. But at Nevada, where the failures had been more decided, the business was almost entirely abandoned, and the miners turned their attention to the hill diggings, then just beginning to be prospected. The Gold Tunnel mill was kept in operation, and yielded good returns, but for several years the dependence of the population was almost entirely on the placer mines. The few companies that continued operations, however, were measurably successful, their mines at times paying largely, and this was an inducement for others to resume work on their lodes, particularly at seasons of the year when water could not be procured to work the placer mines. By 1857 the Grass

Valley mines were in quite a flourishing condition, and continued to prosper for the three or four succeeding years, becoming the leading interest of the town, while at Nevada the business steadily improved.

The development of the quartz interest, however, was destined to meet another reverse, though by no means so disastrous and discouraging as that of 1852–'53. The discovery of silver in Washoe was first made public in this county in the summer of 1859, and quite a number of our most energetic quartz operators hastened to the new mining field. The wonderful richness of the Comstock lode was fully determined that fall, and the next spring witnessed the exodus of many of our best working miners, who abandoned their claims here for what appeared to be the more promising field of enterprise east of the Sierra Nevada mountains. For three years there was a constant drain of population and capital from the county—the capital, especially, being much needed in the development of our own mines. Added to this drain upon our resources, the most of the best-paying mines in Grass Valley were flooded during the severe winter of 1861–'62, requiring many months to place them again in working condition, during which time there were no returns and the expenses were heavy. From these causes business was greatly depressed and property depreciated very materially in value, especially at Grass Valley and Nevada. In 1864 the adventurers who had left for distant mining regions began to return, satisfied that this county presented the best field for mining enterprise on the coast. As a consequence, the quartz business speedily revived, and at the present time Grass Valley is the most prosperous mining town in the State, her prosperity being due entirely to the surrounding quartz mines.

Without taking into account the temporary drawbacks, the quartz business has been improving since 1853, and the yield of gold from that source has steadily increased. The successful operations have in nearly all cases been conducted by practical miners, who learned the business here, and who have discovered and brought into use all the improved methods of mining and reducing the ore, and amalgamating and collecting the gold. Very little foreign capital has been invested in our mines, although there is not a mining region in the world that offers better inducements for judicious investment. The comparatively small amount that has been invested by capitalists in this county has, in most cases, been in dividend-paying mines, and, of course, was no assistance in developing our resources. At no period since the wild speculations of 1852 has quartz mining been in more favor than at present, or the prospects more flattering.

There are in the county four distinct quartz-mining districts, in different stages of development, viz: Grass Valley, Nevada, Eureka, and Meadow Lake.

GRASS VALLEY DISTRICT.—The Grass Valley district is, beyond question, the most important and prosperous quartz-mining region of California. The mines have been worked uninterruptedly since 1852, and, though there have been many failures, and some of the best mines have at times been temporarily abandoned, yet the miners persevered, until the business is now established on a firm basis. It is not possible at present to obtain accurate statistics of the gold product of the Grass Valley mines, but, from the best information that can be obtained, the yield, up to the beginning of the present year, is estimated to have exceeded $25,000,000.* The lodes of the district are narrow—some of those which have been most productive not averaging over a foot in width—and the bed-rock, or what is called by vein miners the "country" rock, is mostly greenstone and slate. The lodes run in every direction, though the principal mines which have been opened and worked usually approximate an east and west or north and south course. The average yield of the Grass Valley mines has been variously estimated at from $20 to $35 a ton; but the higher estimates have undoubtedly been based on the yield of the best-paying mines, examined by scientific gentlemen and passing strangers, who have written on the subject, and who had no knowledge of the large amount of rock worked at Grass Valley, which scarcely paid for hauling and crushing. Taking all the rock worked in the district, $20 a ton would be a fair estimate for the average yield. The cost of mining the rock depends on the size and situation of the lode and the character of the enclosing rock. With a lode of two to three feet in width, which can be worked by means of tunnels, the cost of extracting the vein-stone may not exceed $1 or $2 a ton; but where the vein is small and enclosed in blasting rock, and steam has to be used for hoisting and pumping, the cost sometimes reaches $20 and $30. The charges for reducing ore at the custom mills range from $2 50 to $5 a ton, depending on the character of the ore, the amount furnished, &c.

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* Professor Silliman, in his report of March, 1865, estimated the entire yield as then exceeding $23,000,000.

THE EUREKA MINE, now regarded as the most valuable gold mine in the county, and perhaps the most valuable in the world, is situated a mile and a quarter northeast of the town of Grass Valley, and was located early in 1851. It was worked at intervals, by various parties, up to 1857, but the most of the rock failed to pay for crushing. In the latter year it was purchased by Messrs. Fricot, Ripert, and Pralus, and the first crushing made by them; the rock, being taken from near the surface, yielded only $4 a ton. From 1857 to 1863, the mine was worked to a perpendicular depth of 50 feet, during which a large quantity of quartz was taken out, none of which paid largely, and the greater portion failed to pay expenses. Becoming satisfied, at length, that the mine was a good one, they sank a vertical shaft, in 1863, to the depth of 100 feet, and the mine has since been yielding handsome returns. On the 1st of October, 1865, the mine was sold to a company of capitalists for $400,000 in gold coin. How much it had yielded up to that time is not known, but the owners erected hoisting works and a 20-stamp mill, all at a cost of $60,000, besides receiving large dividends from the profits. The mine has been producing, under the present management, at the rate of about $49,000 a month. The first year, ending September 30, 1866, the gross product was $531,431, and for the eleven months ending August 31, 1867, $588,139, making a total of $1,119,570 in 23 months. Nearly a thousand tons of rock have been taken from the mine every month and reduced at the mill, the average yield being not far from $50 a ton; and the monthly expenses, including repairs to machinery and permanent improvements, have averaged about $16,000. The regular monthly dividends for over a year past have amounted to $30,000, and one or two extra dividends have been declared in addition. The Eureka mine is opened by an incline shaft, 5 by 20 feet, which is designed to explore the vein to a great depth, and is now down nearly 500 feet. Levels have been run from the shaft at distances of 100 feet apart, and for 700 feet along the lode. At 50 feet from the surface the quartz paid $15 a ton, and increased to $28 at 100 feet. Between the 100 and 200-feet levels the average yield was $37 a ton, and below that the average has been $50. The vein runs nearly east and west, dipping south at an angle of about 78°; and over the whole extent of some 700 feet which has been worked the average width is about three feet. At the fourth level the mine is said to show still further improvement, with an increase in the yield of ore, though it has been worked but little below the third level. The value of the mine, with the mill, hoisting works, and other property connected therewith, is now rated at about $1,000,000. William Watt, a successful quartz miner and one of the owners of the Eureka, is the superintendent.

THE GOLD HILL MINE, the first discovered at Grass Valley, was worked by various companies, and with little interruption, for a period of 14 years, yielding in that time, according to popular belief, $4,000,000. At times the mine paid enormously, the quartz being fairly knit together with gold, and again the receipts would fall below expenses, the gold being found in "pockets," and apparently distributed through the vein stone in the most capricious manner. The mine was worked to the depth of 300 feet on the slope of the lode, and for a length of 600 or 800 feet, but the upper levels are now mostly filled up and inaccessible. The vein is very irregular and crooked, and perhaps does not average over a foot in width. The work on the mine was suspended in September, 1865, but operations have lately been resumed, with fair prospects.

THE MASSACHUSETTS HILL MINE, which is believed to be identical with that on Gold Hill, was worked by different companies up to 1866, yielding in that time over $3,000,000. The working of this mine was attended with more than the usual vicissitudes of gold-mining, some of the companies failing most disastrously, and others realizing large profits. The failure of the Mount Hope company, working the mine from 1856 to 1858, was the occasion of a most shocking tragedy. Michael Brennan, the superintendent, having hopelessly involved the company, murdered his wife and three children and then committed suicide. The deed was committed on the 21st of February, 1858. The mine passed into other hands, and a year or two later a large body of rich ore was struck within a few feet of where Brennan had abandoned work in despair.

THE OPHIR HILL MINE is situated a mile southeast of Grass Valley, and was located in 1851. The original owners worked the mine a year or two, when they failed, and the property was sold at auction, the purchasers organizing as the Empire Company. This company erected a six-stamp mill, and worked the mine from May, 1854, to September, 1863, the yield in that time amounting to $1,056,234. The property was then sold to other parties, Captain S. W. Lee, one of the purchasers, taking charge, and work was resumed in April, 1865. The product of the mine from that period up to June of the present year was $286,082, making a total yield in 13 years of $1,342,316. The amount of quartz worked is estimated at 37,840 tons, giving an average yield of over $35 a ton. The present company have erected a magnificent 20-stamp mill at a cost of nearly $100,000. It is the finest quartz mill in the State, but the mine is not yet sufficiently opened to keep it constantly employed. The mill, hoisting works, and other machinery and property of the company, with the drain tunnel and other permanent improvements on the mine, has cost some $250,000. The Ophir lode runs nearly north and south, and dips westerly at the low angle of 27 degrees. The lode is not large, averaging, perhaps, not over 18 inches in width, but it has been explored by levels for a distance of 900 feet along its course, showing a continuation of rich ore for that distance.

THE NORTH STAR MINE has been worked with varied results since 1852, changing hands several times, once under a forced sale. This mine is perhaps more thoroughly opened than any other in the county, an incline shaft having been sunk on the slope of the vein to the depth of 750 feet, and levels run along its course nearly 1,000 feet. In the five years ending in January, 1867, the net earnings of the mine amounted to more than $500,000, and in the early part of this year the net profits were reported at $12,000 a month. On this representation the mine was sold to San Francisco capitalists for $450,000, of which $250,000 was paid down, and the remainder was to have been paid from one-half the net profits. But the receipts for the first two or three months, under the new administration not coming up to the representations, the sellers released the purchasers from further payments.

THE ALLISON RANCH LODE, which for many years ranked as the leading mine in the State, was discovered in 1855, and worked with continued success over 11 years. It yielded in that period $2,300,000 in gold bullion. In working the mine rich bodies of ore were encountered which paid $100 and $200 a ton, with poorer rock between that scarcely paid the cost of working. An examination of the books of the company shows the average yield of all the rock worked to have been $50, the rock taken from the mine and crushed amounting to 46,000 tons. The mine has been worked to a depth of over 500 feet, and for nearly 1,000 feet along its course. The vein has been an expensive one to work, on account of the large quantity of water that had to be raised and the hardness of the enclosing rock; but probably not less than two-thirds of the gross proceeds were divided as profits among the owners. Owing to a want of agreement in the management the work in the mine was suspended at the beginning of the present year.

There are many other ualuable mines in the district, some of which are now or have been paying regular dividends to the owners. Among these may be mentioned the New York Hill mine, which has been worked at intervals since 1852, and produced not less than $500,000; the Wisconsin, from which was taken, in 1866, 1,400 tons of ore that yielded an average of $51 a ton; the Hartery, which has yielded over $250,000; the Norambagua, a vein not exceeding an average width of five inches, but which yielded over $80,000 in 1866; the Houston Hill mine, which yielded over $500,000 in the past three years, and paid good profits, although the cost of extracting and reducing the ore amounts to some $40 a ton; the Osborn Hill mine, which was producing large returns at a time when the quartz interest of the district was supposed to be on the wane; the Lone Jack, which has produced over $500,000; the Cambridge mine, on Howard Hill, and the claim of the Lucky Company on the same lode, which have been opened at great cost and are regarded as promising mines, though at present idle on account of disagreements among the owners; the Union Hill mine, and the adjoining mine of Wm. O'Connor Sydney, which is now being opened and explored in the most systematic manner and without regard to expense; besides numerous others in the district which would be tiresome to sketch in detail.

There are now some 30 dividend-paying mines in the district; 28 quartz mills, having an aggregate of 300 stamps, and the capital invested in the mills, hoisting works, and other machinery, and in the opening of the mines which may now be considered as available, is about $2,000,000. The number of men employed in the mills and mines is about 1,600, and the yield of the mines in 1866 was $2,000,000, in round numbers—an average of $1,250 for each man. The product of the district will probably be somewhat less the present year than in 1866, on account of the suspension of work in the Allison Ranch and some other mines, but the falling off will be only temporary, as the mines are too valuable to remain idle for any great length of time.

NEVADA QUARTZ DISTRICT.—The Nevada quartz district includes the township of that name, though the most of the gold-bearing lodes are situated in the Nevada basin, forming an area of eight or ten square miles. The primitive rock in the basin is a soft granite, encircled by a slate formation on the east, south, and west. Numerous quartz lodes, both in the granite and surrounding slate, have been opened and worked more or less—the general course of the veins being a little east of south and north of west, and the most of them having an easterly dip at various angles. Some are nearly perpendicular, and others descend at a low angle, the more usual dip being about 35 or 40 degrees. At the southwesterly end of the granite formation are a number of parallel veins, having the same general course, but dip westerly. The most noted of these are the Sneath and Clay and the Mohawk. All the lodes in the district which showed any surface croppings were located in 1851, during the first quartz excitement, and it being then understood that they were the sources from which the placer gold was derived, the most extravagant expectations were formed as to their prospective yield. Mills were erected at great expense, and a large amount of ill-directed labor was expended in endeavoring to open the veins; but, with two or three exceptions, the enterprises were failures, and quartz was very generally pronounced a humbug.

THE GOLD TUNNEL MINE, situated west of Nevada City, but mostly in the corporation limits, was the only one in the district in which operations were continued without interruption. This was the first gold-bearing lode discovered in the district, and the discoverers worked it for a time by washing the decomposed quartz in a rocker, realizing large profits. In the spring of 1851 a tunnel was started on the lode, and the following summer a six-stamp mill was erected on Deer creek, near the mouth of the tunnel, to crush the rock. From 1852 to 1855 the mine was worked by E. W. Kidd, who owned a controlling interest, and in the latter year the property, including the mill and mine, was sold to a company of Cornish miners. Up to this time the mine has yielded over $300,000 in gold, the rock paying on an average $50 a ton, though worked in a mill that would not now be used. The Cornishmen worked the mine over eight years, suspending operations in 1863, but the yield during that period is not known. A continuous body of rich ore extended from the mouth of the tunnel at Deer creek for a distance of 600 feet north; beyond that the rock contains gold, but not in sufficient quantities to pay for working. The vein has never been worked below the level of Deer creek, but there is no doubt that it will eventually be opened to a great depth, and worked again with profit.

THE ILLINOIS AND CALIFORNIA CLAIMS, situated on the gold tunnel lode south of Deer creek, have been worked at intervals since 1851, and at times have paid largely. In 1866 the Eagle Company purchased the California claim, erected hoisting works and a 10-stamp mill, and expended a large amount in sinking an incline shaft and exploring the vein. Considerable rock was taken from the mine and crushed, but it did not yield in accordance with the anticipations of the company, and recently the work was suspended. It is understood that operations will soon be resumed.

THE BANNER MINE is situated three miles east of Nevada City, and is a comparatively recent location. Some work has been done on it in 1860–'61 by two different companies, but the indications being unfavorable, they abandoned it. It was relocated in 1864 by the parties from whom the present owners derive their title, and the first crushing yielded only four or five dollars a ton. After a suspension of some months they took out another crushing, which yielded near $20 a ton, and this gave the mine a good reputation, which it has ever since sustained. With two or three temporary interruptions, the mine has been worked from June, 1865, up to the present time. The lode runs nearly north and south, dips to the east at an angle of about 50°, and is opened by an incline shaft sunk to the depth of 350 feet on the slope of the vein. Four levels have been run in each direction from the shaft, the upper one being 60 feet from the surface, the next 60 feet deeper, and the other two at distances of 100 feet. Two "chimneys" of rich rock, or "ore shoots," as they are commonly called by the miners, have been found in the lode, both of which rapidly widen with the depth. At the first level, 60 feet below the surface, the large ore chute extends along the course of the lode only about 100 feet; but at the third level, 160 feet deeper, it has a breadth along the lode of 225 feet. North of the main ore chute another body of rich quartz has been struck, which has a breadth of 40 feet at the second level and 75 feet at the third level. If they continue their course they will come together at the fourth level, thus affording continuous rich ore for a distance of about 500 feet along the lode. Outside of the ore chutes the quartz pays only $8 or $10 a ton, barely sufficient to cover the expenses of mining and reducing it. Up to the 1st of January, 1866, 5,000 tons of rock had been taken from the mine and reduced, yielding an average of about $19 a ton. From the 1st of January to the 1st of September, of the present year, the yield has been $76,000 from 3,000 tons of rock worked, an average of $25 33 a ton. The vein is of good size, being from three to four feet in width, and is now yielding from 30 to 40 tons of quartz daily. The owners have a 20-stamp mill convenient to the mine, and besides keeping this employed, they are having considerable quartz worked at custom mills.

THE PITTSBURG MINE, more commonly known as the "Wigham," is situated a mile and a half southeast of Nevada City, on the slope of the hill descending into the basin. It was located in 1851 for a Pittsburg mining company, by R. S. Wigham, who erected a mill the same season, but the enterprise was among the early quartz failures. The property finally fell into the hands of Merritt & Bourn, of San Francisco, who still retain it. The mine was worked on a lease in 1855, and again in 1857, but with indifferent success. In 1862 it was leased to Weeks & Thomas, who, in the course of 15 months, took out 3,700 tons of quartz, which yielded at the mill an average of $22 a ton, and the profits to the lessees amounted to near $40,000. The mine was then idle until January, 1866, when the owners made arrangements for further explorations. Another level was opened, and in the course of the year the mine yielded $102,000 from 1,700 tons of rock—an average of $60 a ton. A mill and first-class hoisting works were erected last spring, and started in operation about the 1st of June, but we have no report of the yield for this season. At the upper level the ore chute extended only about 50 feet along the lode; but in the lower level, 380 feet on the slope of the vein, it has a breadth of 400 feet. The average width of the vein is about two feet, and the country rock is slate. The Wigham and the Banner are the leading quartz mines of Nevada district at the present time.

THE MINE OF THE NEVADA QUARTZ MINING COMPANY, commonly known as the "Soggs" mine, is situated a mile west of Nevada City, and is a parallel vein with the Gold Tunnel. The lode was located at an early day, but no successful effort was made to develop it until 1857. A rich chimney having been discovered by the owners, they made arrangements for the erection of an eight-stamp steam mill to work the mine. This was run two or three years successfully, when it was taken down, and the owners put up a new 12-stamp water mill on Deer creek, and the mine has been worked, with one or two brief interruptions, for 10 years. About 5,000 tons of rock have annually been taken from the mine and crushed at the mill, the gross receipts ranging from $40,000 to $70,000 a year. During the year 1866, according to a statement furnished by William M. Ratcliff, the superintendent, the amount of rock crushed was a fraction under 5,000 tons, which yielded at the mill $42,000; while the returns from sulphuret ore shipped to Swansea and concentrated sulphurets netted $8,000. The average yield of all the rock crushed has been about $13 a ton, yet the owners have at times derived large dividends from the working of the mine, and, with the exception of the construction account of the first mill, but one assessment has been levied, and that only for a trifling amount. The lode is one of the largest in the district, though very irregular, ranging from a mere seam to 16 feet in width, and averaging about four feet. It is opened by three tunnels, starting in above the mill and running north. The length of the upper tunnel is 2,900 feet, and the other two about 1,900 feet each. The rock is taken from the mine in cars and dumped in front of the stamps, thus saving the cost of hauling; and having a large lode, and the advantage of water-power to run the mill, the owners have been enabled to work a low grade of ores with profit.

THE SNEATH AND CLAY MINE, situated a mile southeast of Nevada City, was discovered in the spring of 1862, and several lots of the quartz crushed during the next summer yielding good returns, the locaters erected a mill, which was started in operation about April, 1863. For a time the rock yielded largely, the gross product in two years being $180,000, of which over half was clear profit; but the owners were unable to agree in the management, and having worked out the opened levels the property was sold in May, 1865, to a New York company for $27,000. The mill and hoisting works had cost $45,000. The New York company opened two additional levels, which having been worked out to the extent of the pay ore, the work was suspended in the summer of 1867. The mine is believed to be a good one, and had it been judiciously managed from the start, and the "dead work" kept well in advance, it might have been profitably worked for a long period.

THE LECOMPTON MINE, three miles above Nevada City, on Deer creek, was located in 1858, and in the course of two years the net proceeds amounted to $60,000, the quartz averaging $40 a ton. The gross yield of the mine up to 1863 was $220,000, and it has been worked but little since, the pay ore above the level of the creek being exhausted. This lode is situated near the junction of the granite and slate, and cuts through from one formation to the other without changing its course or dip.

There are numerous other mines in the district which have at times afforded large profits to the owners, but which are now idle, either from bad management or other causes. Among those now being worked may be mentioned the Cornish, the Pennsylvania, the Providence, and the Murchie, which have mills connected therewith, and the Cunningham, Mohawk, Mattingly, and Harvey. All of these have yielded good returns, and are still worked with fair success.

There are now in the Nevada district 17 quartz mills, having an aggregate of 137 stamps, and the capital invested in the business is about $500,000. The total yield of the mines in 1865 was about $400,000; in 1866, according to statistics kept by Wells, Fargo & Co., it was a fraction less than $500,000, and will be about the same in 1867. The number of men employed in the mines and mills is about 450, the gross yield being equal to $1,100 for each man. A considerable proportion of the quartz miners are either prospecting or engaged in opening veins, which are not now productive.

EUREKA QUARTZ DISTRICT.—Within the past year or two considerable attention has been given to the development of the quartz lodes near the town of Eureka, some twenty-five miles above Nevada City. The general characteristics of the Eureka district resemble, in many respects, those of the Nevada district, the country rock being a soft granite, which can be excavated in most places without the aid of powder, and the course of the veins being east of south and west of north, corresponding with the mountain range. This quartz belt crosses the South Yuba into Washington township, where the enclosing granite is hard, which greatly enhances the cost of working the mines. In the slate formation, which comes in half a mile west of the town of Eureka, there are numerous well-defined quartz veins, but they contain very little gold, and with one or two exceptions are considered valueless.

In 1856 a quartz lode was located on Gaston ridge, some miles south of Eureka, and a mill was erected to work it a year or two later, which was run with little interruption until November, 1863, when it was destroyed by fire. In that time some 15,000 tons of quartz were extracted from the mine and crushed in the mill, yielding an average of $8 or $9 a ton. The mill was an inferior one, having no pans or other improved methods of saving the gold; but the vein being large and favorably situated for working the owners realized a small profit, though not sufficient at that time to justify them in erecting a new mill. Two other mills were built in the district in 1857; but one was sold on account of a disagreement among the owners, and the machinery moved away; and the other, after doing a fair business for two or three years, was taken down and moved to Washoe at the beginning of the silver excitement.

No further attempt was made to develop the mines of the district until the spring of 1866, when some of the old residents, having worked out their placer claims, and others who had noted the favorable indications, commenced operations in earnest. A couple of arrastras were erected near the town, run by water power, and capable of reducing three tons of quartz in 24 hours. These arrastras have been constantly employed, have done excellent work, and been of great advantage in prospecting and determining the value of the mines. During the summer and fall of 1866, Messrs. Black & Young erected a 10-stamp mill on a lode situated about a mile south of town. Operations, however, were not fairly commenced on the mine until May last, since which time the mill has been running steadily, and the quartz is yielding from $20 to $25 a ton. Two other mills were also built the same season, one of five stamps to work the Jim lode, and the other of four stamps, intended for custom work. Two new mills are now in course of construction, one of 10 stamps to work the Veatch and Powell mine, and the other of five stamps on the Birchville mine. Both of these mines have been thoroughly prospected, are of good size, and the gold is found in paying quantities very generally disseminated through the vein-stone.

TECUMSEH MILLS.—Some years ago two mills known as the Tecumseh and Star were erected in Washington township, but on the same quartz range. Considerable quartz has been worked in both mills, which yielded fair pay; but owing to want of means to properly open the mines, the expense being very great on account of the hardness of the enclosing rock, the enterprises have not proved successful. The Star Company, however, is still prosecuting work, and the Tecumseh mill has lately been leased to parties who are prospecting other lodes.

THE GRIZZLY LODE, situated four miles west of Eureka, in Devil's cañon, was purchased by the Eagle Company, of Hartford, about the beginning of 1866. The company erected a five-stamp mill at the mine in the fall of the same year, but being unprepared for winter work, little was done in developing the lode until May last, since which time the mill has been running steadily and with favorable results. The vein has an average width of four feet, runs in slate, and is opened by tunnels. It is so situated that, with proper arrangements and a larger mill, $6 and $8 quartz can be worked with profit. As long ago as 1854 a mill was erected on a lode called the National, about half way between Eureka and the Grizzly. This mill was run a year or more, a portion of the time being leased, but the yield of the quartz was not sufficient to pay with the prices then ruling. The work was suspended in 1856, and the mill was destroyed by fire a year or two later. The Grizzly and National are the only quartz lodes yet discovered in the slate formation of that region that have exhibited sufficiently favorable surface indications to justify an outlay of capital to develop.

About 250 men are engaged at the present time in the quartz mines and mills of the Eureka district, many of whom are prospecting or working on lodes that are not yet productive. There are 10 mills in the district, including the two in Washington township, having an aggregate of 60 stamps, and the capital invested is estimated at $200,000. The yield of the mines for 1867, it is believed, will amount to $200,000.

MEADOW LAKE DISTRICT.—The Meadow Lake quartz district is situated near the summit of the Sierra Nevada, but on the western slope. It derives its name from a large mountain lake, used by the South Yuba Canal Company as a reservoir, a dam having been constructed across its outlet to retain the water in the spring, and is let out into the company's ditches as fast as needed by the miners. Gold-bearing quartz lodes were discovered near the lake in 1863, others the year following, and in 1865, some of the lodes giving indications of extraordinary richness, considerable excitement was created throughout California and Nevada State, causing a rush of adventurers to the locality. The real work of developing the mines was not commenced until the summer of 1866, and considering the many disadvantages, including the deep snows of winter, has progressed favorably, though not, on the whole, equal to the anticipations of the first adventurers and locaters.

The country rock of the district is sienite, and usually has to be blasted in making excavations; but this disadvantage is partially compensated by the size of the veins, which will average considerably larger than those of Grass Valley and Nevada. The general direction of the lodes is northwesterly and southeasterly, and they are easily traced by the dark, reddish appearance of the croppings, caused by the oxidation of the iron pyrites encased in the quartz. The quartz contains an unusually large proportion of sulphurets, averaging, it is said, 20 to 25 per cent. The sulphurets yield by assay $60 to $70 a ton, and are successfully reduced by the Plattner chlorination process, works for that purpose having been constructed in the district. Seven quartz mills have been built in the district, having in all 62 stamps. The mills, however, have not been running regularly, having been erected in advance of the development of the mines. Of several hundred quartz veins located in the district during the excitement in the summer of 1865, 50 or more have been partially developed and given indications of value.

The U. S. Grant Company, whose mine is situated six miles south of Meadow Lake, and within four miles of the line of the Central Pacific railroad, has been the most successful of any in the district. The owners of the mine have kept a five-stamp mill running most of the time during the past year, and the quartz worked has paid largely. They are now building a larger mill, while the work of developing the mine is continued. The Golden Eagle, Mohawk, Montreal, California, and Excelsior companies have also erected mills and made fair progress in the development of their mines.

The number of men employed in the mills and mines of the district at the present time is about 200, and the available capital invested may be set down at $200,000. The yield of gold this year will be about $50,000. Much of the labor and capital is being expended in opening mines which are not now productive; consequently, if the mines are equally as good, the yield will not be as large in proportion to the men employed as in the older districts. There are no placer mines in the district, or at least none have been discovered.

Table showing the number of men employed, the capital invested, and the gross yield of the mines of Nevada county, California.

	Men employed.	Capital invested.	Gross yield.
Placer and hydraulic mines	2,000	$1,500,000	$3,500,000
Cement mines	300	400,000	300,000
Quartz mines—			
Grass Valley district	1,600	2,000,000	2,000,000
Nevada district	450	500,000	500,000
Eureka district	250	200,000	200,000
Meadow Lake district	200	200,000	50,000
Canals and ditches	200	1,000,000	....
Totals	5,000	5,800,000	6,550,000

Note.—In estimating the capital invested in mining, the design has been to include the cost of machinery, tools, &c., as well as the labor expended in opening claims which are now considered of value, and excluding those that have been worked out or proved failures. The ditches might be considered as a part of the capital invested in the placer mines, as the water is mostly used by the placer and hydraulic miners.

SECTION X.

SIERRA COUNTY.

The Sierra, the principal drift mining county of California, lies between the middle Yuba and Slate creek. The lowest point in the county is probably 2,000 feet above the sea, and most of the mining camps are at an elevation of 4,500 feet or more. The surface is cut up by numerous cañons, about 2,000 feet deep, and not one acre in 50 is fit for the plough. There are numerous high peaks, among which are the Dounieville Butte, 8,500 feet; Fir Cap, Saddle Back, Table mountain, and Mount Fillmore, each about 7,000, besides numerous others. The Dounieville Butte is one of the landmarks of the State, being visible from a large area in the Sacramento valley, and it is remarkable for the ragged outline of its summit. The county is so rough that only two wagon roads enter it west of the summit of the Sierra, one on the divide, between the middle Yuba and the north Yuba, and another on the divide between the Slate creek and Cañon creek. No road crosses the county from north to south. The principal mode of travelling is mule-back riding. The snow is very deep at the higher camp, lying in some of them three or four months in ordinary winters. Most of the mines are on old channels, high above the present streams, so high that the introduction of water is very expensive. There are few ditches, and many claims are not able to wash more than four or five months in the year. Two old channels cross the county. The main Blue lead, which crosses Nevada and Placer, is worked at Deadwood, Sebastopol, Little Grizzly, Excelsior, Monte Cristo, City of Six, Forest City, Chipps Flat, and Minnesota. All these have been mined mainly by drifting, and all save the three first are much less flourishing now than they were from six to 10 years ago. This channel runs from the northwest to the southeast.

Another channel which seems to run from the northeast to the southwest, passes through La Porte and Brandy City, thence to Camptonville and San Juan. This channel is not covered, as the other is, by heavy layers of tufa, lava, or volcanic sand, and the auriferous gravel coming to the surface offers excellent opportunites for hydraulic mining, which is or has been carried on extensively at all the points named.

A channel found at Howland Flat and at Cold Cañon, and another found at Morristown, Craig's Flat, and Eureka, are supposed to be tributaries of the main Blue lead.

La Porte and Port Wine, which belonged to Sierra county previous to 1866, were given to Plumas in that year by a legislative act, which was entitled "An act to better define the boundaries of Plumas county," and was passed without any suspicion on the part of the representatives of Sierra or the members generally that it took a rich mining district from the latter county.

The blue cement found in the Blue lead in Sierra county is soft, and it yields three-fourths of its gold or more at the first washing, so there is no cement mill in the county. In the eastern part of the county is Gold lake, which has the appearance of being in the crater of an extinct volcano.

A belt of limestone is observed between Dounieville and the Sierra Butte, and it may be that the belt which appears near Magalia, in Butte county, is the same.

The State and county taxes in Sierra are $2 91 on $100 of taxable property, and the county debt is $30,000.

Brandy City.—Brandy City, the principal hydraulic camp of the county, uses about 3,000 inches of water in piping claims, of which there are twelve, some of them using 500 inches. The lead is 200 feet. The supply of gravel will last 10 or perhaps 20 years.

St. Louis and Neighboring Towns.—St. Louis has 10 or 12 hydraulic companies working, and using in all 1,000 inches of water, with a pressure of 100 feet.

Cedar Grove has drift diggings, but is doing nothing this year.

Pine Grove, a mile below Howland Flat, was an important place before 1862, but in that year the latter town grew up, and the former declined. All the mining is done by drifting, save in one piping claim.

Rabbit Point, a mile below Pine Grove, has two hydraulic claims, which are 100 feet deep, and together employ thirty men during the water season, which lasts three or four months.

Chandlerville, a furlong below Rabbit Point, had rich hydraulic claims from 1853 to 1857, but they are now worked out, Pine Grove, Rabbit Point, and Chandlerville together purchase 700 inches of water in the water season.

MORRISTOWN.—The diggings at Morristown are remarkable for the presence of larger quartz boulders, and more of them than any other hydraulic claims in the State. A stratum 10 or 15 feet deep is made up chiefly of boulders that weigh over a ton, many of them being from five to 10 tons in weight.

There is only one company, the American, now piping in Morristown. They own all the water that comes into the place, and as it runs only two or three months, they want it all for their own use. When their flume is full they have 1,000 inches. They employ 40 men during the water season. In 186[illegible] they took out $20,000, and paid very little dividend. The bank is 50 or 60 feet deep.

MINNESOTA.—At Minnesota the pay channel is a quarter of a mile wide, but the pay is not equally distributed over it, for there are parts that are barren. If one side is rich the other is probably poor; and if much gold is found on a bank or bar, there is little likelihood of finding a rich bed. The bed rock is serpentine, and the pay stratum is from three to five feet thick. The gravel is made up chiefly of quartz, usually from two to six inches in diameter; and it is soft enough to wash, but so tough that it is not entirely disintegrated until it has been washed three or four times. The fourth washing however does not pay, and the dirt of most of the claims has been washed only twice. The second washing pays better than the first. The gold is coarse, many pieces weighing an ounce, and it frequently happens that in large lots of dust there is not a piece worth less than 25 cents. Most of the pieces are worth $2 or more. The sluices are usually about 400 feet long, with a grade of 16 inches to 12 feet, and no quicksilver is used in them. The fine gold is lost in sluices so short and steep, and tail sluices pay well. The car load must yield 50 cents or the claim will not pay for working. The ground is solid and the sides of the tunnel need no lagging; but a cap supported by posts is required to secure the roof. The pay stratum is usually soft enough to be picked down.

The Blue Lead was discovered here in 1852 by some surface miners who followed up a rich deposit in Taylor's ravine till it ran out, and then they hunted along the side till they found the place where the lead went into the hill. It was very rich, and for a long time Minnesota had some of the best drift digging in the State. Only four claims are worked now. In 1853 400 miners were employed here, and they made on an average $12 or $15 per day, and now there are 100, who average $3 per day.

The Keystone Company have been at work since 1859, employ 18 men, and the yield is probably $6 or $8 to the man per day.

The Wisconsin Company have been taking out pay most of the time for eight years, employ 10 men, and get $6 or $8 per day to the man.

Chipps's Flat is doing very little in the way of successful mining, but there is some prospecting in progress.

Alleghany has the credit of having produced $400,000, but the flush times passed away six or eight years ago. The money was nearly all obtained by drifting, and there was bad drainage and little systematic working. The bed rock swells badly, and in places the timbers must be put in as thick as they will stand, and reset every week. There were claims which paid well, but when work was stopped not half of the pay dirt was extracted.

A company called the Alleghany Consolidated Mining Company has been formed to rework this ground. They have purchased eighty acres of claims, and are about to commence the cutting of a tunnel to be large enough to use mules for hauling in the cars. They will run out by their own weight.

In 1858 there were 18 tunnel companies at Alleghany, all paying; now only 25 men are at work there.

Water was supplied by a very costly ditch, which was allowed to go to ruin when the miners had no longer any considerable quantity of dirt to wash.

The Oregon Company took out $400,000, the Buckeye $200,000, and the Empire $200,000.

The Blue Lead was found at Forest City by the Dutch Company, which obtained two or three ounces to the pan, and brought water to their sluice in a canvas flume.

The claims at Forest City are situated on the south side of a ravine, north of which the lead has not been found, although a tunnel has been run half a mile into the hill.

At one time there were 20 companies working at Forest City and all making money, and now there is only one at work.

Live Yankee Claim.—The principal claim at Forest City is the Live Yankee, which has 360 feet of front and a depth of 2,600. The following table shows the receipts, expenses, and dividends, from 1854 till 1863, inclusive:

Year.	Receipts.	Expenses.	Dividends.
1854	$15,243	$7,152	$8,091
1855	95,713	32,385	63,328
1856	85,921	42,691	43,230
1857	95,806	55,616	40,190
1858	84,875	43,973	41,902
1859	129,937	67,303	62,634
1860	84,120	40,236	43,884
1861	60,092	38,192	21,900
1862	30,720	26,970	3,750
1863	31,350	22,800	8,550
Total	713,777	377,318	336,459

Since 1863 the dividends have been about $10,000 per year. The expense of keeping up the mine is considerable. There is a very long tunnel and a long track, that need frequent repairs.

Highland and Masonic.—The Highland and Masonic claim, near Forest City, was worked at first through a shaft 368 feet deep. There was much water in the channel, and steam-pumping and hoisting works were erected at a cost of $75,000. The yield was $300,000, but the expenses were so great that little if any profit was left; and the works stopped, and the hoisting works were burned down. The claim was sold for debt, and the new proprietors bought three claims in front and a bed rock tunnel 4,000 feet long, and by extending the tunnel the claim was worked at much less expense. The yield was $100,000 per month for a time. It is said that under the new management the expenses have been $8,000 or $10,000 more than the receipts. Nevertheless, some dividends have been paid. Some shares of the claim are in litigation, and it is not easy to ascertain the precise production. The water in this claim is acidulous, and a piece of sheet zinc left in it entirely disappears in a day or two, and iron shovels are made worthless in a few days.

Montecristo.—At Montecristo the channel is 200 yards wide, but the pay is only half as wide, and is in a stratum three feet deep. The pay is usually in the middle of the channel. The gold was obtained by drifting until 1862, when piping was commenced, but the supply of water never exceeds 300 inches, and does not last long, so there cannot be much hydraulic washing there. The bed rock swells, and most of the tunnels were allowed to close up three years ago, so that though there were 300 miners in 1857, there are now only a dozen.

Deadwood.—Deadwood is on the ridge between the north fork of the Yuba and Cañon creek, about 6,000 feet above the sea, and it has an old channel, the extent and character of which are not yet proved, but it is supposed to be in the main Blue Lead. The Deadwood claim, 700 feet front on this old channel, has been worked since 1856, has cost $115,000, and has yielded $10,000. Some good gravel has been found, but it does not appear to be in a continuous lead. Fifteen men are now employed in prospecting. There are three tunnels, one 2,500, one 2,200, and one 1,200 feet long.

FIR CAP, SEBASTOPOL, AND GRIZZLY.—At Fir Cap Camp, on the south side of Fir Cap mountain, there is an old channel in which some very rich gravel has been found lately.

Sebastopol, on the south side of the ridge, between the North Yuba and Cañon creek, is supposed to be on the main Blue Lead. Miners have been engaged in prospecting and mining—chiefly prospecting—since 1854, and the expenses have been double the receipts. Three long tunnels have been run.

Little Grizzly, on the north side of the same ridge, and on the same channel, has spent $100,000, and taken out about as much. The New Orleans Company struck pay gravel in 1866, and are doing tolerably well now.

COLD CAÑON.—Cold Cañon, sixteen miles northward from Downieville, and on the southeast side of the ridge between Cañon creek and Slate creek, is directly opposite to Howland Flat, on the same ridge, and apparently on the same channel. The claims at both places are worked by drifting, and the tunnels of each place point in the direction of the other as if they would meet. The channel appears to be 800 or 1,000 feet wide, and the course at Cold Cañon is south 76° east. The grade is from five to seven feet in a hundred. The pay is best where the boulders are largest, and the general width of the pay is 200 feet, and its depth from three to five feet. Over the pay stratum is a deposit of gravel that would pay well if it were accessible with a hydraulic pipe. A stratum of pipe-clay from 20 to 60 feet deep, and another of volcanic conglomerate 500 or 600 feet deep, are the superincumbent matter.

The character of the gravel, of the gold in it, and of the various strata, are the same as at Montecristo.

FASHION CLAIM.—The Fashion Company, at Cold Cañon, have a claim 954 feet in front by about 4,000 feet deep. Work was commenced in 1856, in which year 400 feet of tunnel were cut, at a cost of $10,000. In 1857 286 feet more cut, at a cost of $5,000, bringing the company into pay. Then it was necessary to build a dump-house and sluice, and make other preparations to wash, at a cost of $50,000. In 1858 the receipts were $80,000, and the dividends $18,000; in 1859, receipts $60,000, and dividends nothing; in 1860, receipts $45,000, dividends $1,000; and from 1858 till July, 1867, the total receipts were $430,000, and the total dividends $45,000. In 1865 and 1866 the company took out no pay, but now they again have good gravel.

The gravel yields $1 50 to a car load, the estimated weight of which is 3,000 pounds. Half that yield would pay expenses. There have been places in the claim that paid $4 per car load. The working tunnel is 3,300 feet long. The space worked out is 2,000 feet long by 200 wide. Twenty-five men are now employed. Gold is found three or four inches deep in the bed rock, but the miners dig up a foot and a half of it for convenience of working, as it is softer than the barren gravel, and the pay gravel is not deep enough for them to work in. The bed rock swells badly for six or eight months after the drifts are cut. The posts in the tunnels are crowded together at the bottom by the swelling, so the tunnel is cut nine feet wide at the bottom and four feet at the top, with the posts straddling out at an angle of 55°. In a few weeks or a few months the posts are nearly perpendicular, and they may have to be set back at the bottom several times before they get right. Drifts are run through the pay dirt with a breast 30 feet wide on each side, and two men work at each breast.

SIERRA CLAIM.—The Sierra Company, 1,800 feet front by a mile deep, is the only company besides the Fashion at Cold cañon. The company commenced work in 1858, and in 1864 they reached pay in a tunnel 3,000 feet long, after spending $70,000. Since they began to wash their expenditures have been greater by $5,000 than their receipts; so they are now, at the end of nine years, $75,000 out of cash, exclusive of interest. The claim, however, is valuable, and will last twenty years. The working of the last three years would have been profitable if the company had not changed the grade of their tunnel and raised up, so that they got too high for drainage and for easy transportation of their gravel. They have lost much time and labor, and have had to go back and run in on the original level at a cost of $10,000. Their receipts now are $46,000 per year. Their expenses are $35,000 for labor, at $3 50 and $4 per day; $3,500 for timber delivered, $1,200 for candles, $300 for oil for cars, $100 for steel rope, and $5,000 for other materials, including powder.

Twenty-five men are employed; and two of them are kept busy repairing the tunnel and the track, principally on account of the swelling of the bed rock; 60 car-loads of gravel, weighing 3,000 pounds each, are extracted every day; 100 loads are thrown into a dump-box, and then the mass is piped away. The sluice is 500 feet long, and 75 per cent. of the gold is obtained in the first three boxes. The gravel, after passing through the sluice, is saved and is washed a second time, but 97 per cent. of all saved is caught at the first washing. Chinamen, however, catch the tailings in the creek after the second washing and put them through the sluice again. The space worked out so far is 500 by 100 feet.

HOWLAND FLAT.—Howland Flat is now the most prosperous mining camp in the Sierra and the most productive drifting camp in the State, unless Fir Cap has surpassed it. The shipment of gold this year will be about $300,000; it was twice as much annually for four years previous to 1866. The shipment for February, 1867, was $23,000; for March, $10,000; for April, $24,000; for May, $31,000; for June, $31,000.

The flat from which the place obtained its name is worked out, or, at least, has been worked over by drifting. It would, perhaps, pay for piping on an extensive scale. The diggings now worked are under Table mountain, and are of the class known as hill diggings. They are in an old channel from 400 to 700 feet wide, with a pay stratum from three and a half to ten feet deep. The boulders in this stratum are all of quartz, some of which weigh a ton. The best pay is among boulders weighing from 100 to 500 pounds. There are large quantities of sulphurets in the gravel, and it would probably pay to collect them by concentration.

THE SNOW AT HOWLAND FLAT.—The town is situated about 6,000 feet above the sea, on the north side of Table mountain, which is a rallying point for snow-storms, and snow-drifts collect deeply on its northern slope every winter. Rain is comparatively rare, and there have been winters almost without rain, though snow was abundant. Last winter snow fell about 16 feet deep on a level near Howland Flat, but by drifting it got 25 feet deep in the town, and it lay in the streets till the 1st of June, and deep drifts were still lying on the mountain side within half a mile in the middle of July. For three months the snow was so deep that most of the chimneys were below its level, and people went from house to house either through tunnels or by climbing up to the house-tops and going over the surface.

Last winter an open reservoir 100 feet square, containing running water, could not be found, although a pole 20 feet high had been fastened on it to mark the place. The water in this reservoir was eight feet deep, and was supplied by springs, and a steady stream ran from it. The snow over it was white, as clear and as hard as that over the adjacent land, and several attempts to find it were vain. The water was several times exhausted, but the snow did not change its place or its appearance.

The abundance of the snow and its long duration renders it necessary for the people to accustom themselves to snow-shoes, and snow-shoe races are the chief amusement in the winter. People travel 20 or 30 miles across the country to see them, and large sums are bet on the results. The racing ground is always on a long slope, down which the racers slide at a speed that sometimes reaches a mile a minute. The shoes are thin pine boards, 12 or 16 feet long, 4 inches wide, turned up at the toe.

UNION CLAIM.—The principal claim at Howland Flat is the Union, 2,000 feet in front by 3,300 deep. The Bright Star Company began work in 1857, and in 1859 they failed, with debts amounting to $40,000, and they had paid $50,000 as assessments. The Union Company succeeded to the ownership of the mine, and spent $30,000 over and above receipts, and did not get any dividends until two years later. Four years' time and $120,000 of cash were required to bring the mine into a paying condition.

It is now trying to make amends. Its total yield has been about $900,000. The yield for the last 18 months has been as follows:

	Yield.		Car loads.	Wages.
	Ounces.	Value.		
First half of 1866	3,181	$56,680 44	41,950	$27,150
Second half of 1866	2,870	50,660 00	33,160	22,293
First half of 1867	3,183½	57,307 50	48,167	29,556

Eighty men are employed, at from $3 to $3 50 per day. The cost per car-load, exclusive of labor, is 10 cents. Round timbers, from 12 to 18 inches in diameter, and from five to eight feet long, for gangways and tunnels, cost 60 cents each. Breasting posts, eight inches square and from three to seven feet long, cost 12 cents each. Caps, 30 inches long, 12 wide, and 6 thick, cost 12 cents each. Lagging, six feet long, five inches wide, and an inch and a half thick, cost four and a half cents each. The cost of all the material is lumped at $10,000 per year.

The bed rock swells, and the tunnel is cut 10 feet wide at the bottom, and four at the top. In six months the sides are nearly perpendicular, the bottom being in the bed rock and the top in the pay dirt, which does not swell. The timbers are usually forced into the bottom by the swelling of the bed rock, and not broken; the rock seldom swells, except near the pay. In some places the posts must be set back in two months; in others, in a year.

An air tunnel four by three feet is cut 20 feet above the pay; 30 feet is left on each side of the main tunnel for support. The dirt is hoisted on an incline by a Fredenbur wheel, driven by 40 inches of water, under a pressure of 124 feet. The water after leaving the wheel is used to wash the dirt. There are 1,200 feet of sluices. It is estimated that there is pay gravel in sight enough to last eight years. Ventilation is secured by having an air drift 20 feet over the working tunnel, communicating with an air shaft 200 feet deep. The gravel is taken out through drifts or gangways 50 feet apart, with breasts 25 feet wide on each side. In 1861 the company obtained the privilege of drainage through the Down-East Company's claim adjoining, by paying $2,000 and giving a strip of ground 75 feet wide and 3,400 feet long. Thus a great expense previously incurred for pumping was avoided.

OTHER CLAIMS.—The Pittsburg Company have 800 feet front, have been at work since 1860, have extracted $500,000, have paid $40,000 of dividends, and having exhausted the pay in sight, are now running for another channel.

The Hawk Eye Company have 800 feet front by 3,500 feet deep. They began work in 1857 and reached pay in 1861, after spending $30,000. Since then they have taken out $360,000, but the dividends have not been over five per cent. of the receipts, and the company are out of pocket. They made the mistake of opening the mine on the upper side, so they had no drainage. They cut a drain tunnel through Union claim, but it closed up in December, 1866. They are now running a new drain tunnel, to be finished in three years, to cost $30,000, and to be 3,000 feet long.

The Down-East Company, who have a frontage of 350 feet, commenced work in 1855. There are 12 shareholders, all of whom work in the mine, and they hire no labor. The claim pays about $2,000 a year over ordinary wages. The total yield has been $425,000, and $240,000 have been paid out as dividends. There is enough pay dirt in sight to last three years.

The Hibernia claim, 600 feet in front and wider at the back, was opened in 1862 by a shaft 180 feet deep, and after being worked two years was sold by the sheriff, and was purchased by the Shirley Company. The total yield has been $125,000. The first company lost $40,000 in the mine; the second is making a moderate profit. There is enough pay dirt to last a year. There are twelve shareholders, who work in the mine, and they employ three or four Chinamen as carmen and pumpers at $1 75 per day.

The Ohio claim is undeveloped. The Black Ball was bought by the Shirely Company and worked out by them. The Sierra, Wild Rover, and Wisconsin claims are undeveloped.

The Sugar Loaf Company have been at work eight or nine years, have pay gravel to last three or four years longer, and have not taken out much more than enough to pay expenses. Some of the company work in the mine. The company have a second claim (numbered 24 on the diagram) which has yielded $120,000 in all, and $25,000 of dividends. Part of the Nevada claim has been worked; the Hollins is undeveloped. The Shirley claim has been worked out, yielding $100,000 gross, and $20,000 net; it was worked four years. The Mountaineer claim was opened in 1859, and is now nearly exhausted; the dirt was brought through a shaft by an engine; the yield was $200,000, and the dividends 10 per cent. of that sum. The Last Chance claim was worked out by the Mountaineer Company.

The French Company opened their claim in 1862 by a shaft, but were compelled by water to abandon it. They started again by a shaft, in 1864, and made it pay expenses. In June, 1867, they bought the Sugar Loaf tunnel, and intend to extend it so as to drain their claim. Their pay will last four or five years.

The Mountain Ranger claim has been worked out, paying no profit. The Wabash Company worked two or three years and lost $20,000. The Empire and Tip Top claims were rich, and were worked six or eight years ago.

Adjoining the Pittsburgh on the east is the Monumental claim, 1,200 feet in front. The tunnel was started in 1863, and after running 2,400 feet it struck rich gravel this year. The company are now raising an air shaft to be 300 feet high, and to cost $3,000. The dump-houses, sluices, stock of timber, cars, &c., necessary as a preparation for washing, will cost $15,000. The expense of the tunnel was $25,000, but the Empire Company, which intends to use it for drainage, has contributed $10,000 towards it.

The Empire Company have 1,000 feet front, with the privilege of working and draining through the Monumental tunnel; but they must cut a tunnel 1,200 feet long, at a cost of $20,000, to reach their pay. They are about to commence that connecting tunnel.

The Virginia began to prospect, but after expending $5,000 had to quit for lack of drainage. The Nebraska Company began a tunnel, but got into very hard rock, and gave it up after expending $10,000. The Gross Company began a tunnel in 1856, have gone in 1,200 feet, expended $55,000, and are now working for wages to get the means of continuing their tunnel, which is still in the bed-rock.

QUARTZ IN SIERRA COUNTY.—Sierra has very few quartz mines that are now profitable, but among those few are several that deserve to be classed among the best in the State. There is one set of quartz regulations for the whole county, and these were published in the report of 1866. Some rich veins have been discovered near Gold Lake, but they have not been developed sufficiently to prove their permanent value.

SIERRA BUTTES.—The Sierra Buttes, or, as it is also called, the Reis mine, is 2,000 feet long, and is situated 15 miles east of Downieville, and the office is 5,100 feet above the sea. The elevation has commonly been placed at 7,200 feet, but barometrical observations have proved that the latter figures are incorrect. The situation is on a steep mountain side, 1,500 feet above the valley of the South Yuba, so steep that there is no wagon road near it. All the supplies are brought by pack animals—even the fire-wood cut in the immediate vicinity.

The mine is situated on a lode which is split up into several branches; the width from wall to wall being from 70 to 100 feet, and of this width from 40 to 70 feet is quartz, with intervening horses or beds of hard blue slate of the same character as the walls. In some places there are two and in others six branches. The course of the lode is a few degrees north of west, and the dip is 40° to the northward. Six pay chimneys have been found, one of them 500 feet long horizontally. All these chimneys are vertical; the pay is irregular in them, skipping from one branch to another; if the chimney disappears in one branch, the miners look for it in the other branch. No pay chimney gives out.

All the rock is extracted through tunnels, of which there are six, the lowest one being 225 feet above the upper mill, the distance from which to the uppermost workings is 1,100 feet, and to the bottom of the mountain is 1,500 feet perpendicularly, or 2,200 feet following the dip of the vein, so that there is a probability of opening and draining the mine to a depth of 3,000 feet by tunnels. There are about 40,000 tons of pay rock now in sight, enough to keep the mills going three years, and to pay $60,000 of profit. The lower tunnel is being extended, and if that should strike the same pay chimneys found above, with the same size and quality, the stock of good ore in sight will be 200,000 tons, enough to employ the mills 15 years, and to pay $3,000,000. This is the most extensive and most promising project now in progress in the State in the matter of opening a mine.

The mine was taken up in 1857, and has been worked ever since—previous to 1857 with arrastras; from 1857 to 1860, with eight stamps, five arrastras and two Chile rollers; from 1860 to 1867, with 24 stamps; and since June, 1867, with 28 stamps. From 1853 to 1857, six tons were reduced per day, or 1,500 tons per year; from 1857 to 1860, 6,000 tons per year; from 1860 to 1864, 10,000 tons; from 1864 to 1866, 12,000 tons; and the present crushing is at the rate of 14,000 tons per year.

The average yield of the quartz has been from $15 to $17 per ton. In 1866 it was over $17. In the last report the receipts, expenses and dividends were given year by year from 1857 to 1865, showing aggregates of $1,120,000 receipts, $385,000 expenses, and $735,000 dividends.

In 1866 the receipts were $224,000; expenditures, $70,000; dividends, $144,000, and $10,000 were retained in the treasury more than at the end of 1865. The yield during the first nine months of 1867 was $156,000, and the dividend was $87,000. The yield previous to 1857 is estimated at $250,000, and the total yield from the discovery to the 1st October, 1867, $1,75,000, and the dividends since 1857, $966,000.

The yield previous to 1857 is estimated at $250,000, and the total yield from the discovery to the 1st of October, 1867, $1,750,000, and the dividends, since 1857, $966,000.

Previous to 1857 the quartz was assorted carefully, and about $40 per ton was obtained from all worked in 1856, and probably as much in 1854 and 1855. The largest dividend in any year before 1866 was $150,000, in 1861, showing that the profit of 1866 was nearly fifty per cent. greater than that of any previous year.

There are two mills, one of 16 and the other of 12 stamps, both driven by the same water, one being below the other, in the ravine. Amalgamation is effected in the mortar and on copper aprons, after leaving which the tailings are ground in 17 arrastras on shares. Three companies, with four arrastras each, pay a quarter of their receipts to the Sierra Buttes Company, which derived $3,000 in all from that source in 1866; and there are five arrastras below, which pay $40 in all per month. These 17 arrastras are all placed in the ravine, one below another, so that all are driven by the same water. The arms to which the mullers are attached are also the arms of the driving wheel, which is horizontal, with perpendicular buckets against which the water rushes under a pressure. The bottom and sides and mullers of the arrastras are of greenstone.

In the summer 60 men are employed, and in the winter from 52 to 54. There are 28 miners, 10 carmen and transporters, nine men in the mills, two carpenters, two blacksmiths, two cooks, and several packers.

INDEPENDENCE.—The Independence mine, 4,500 feet long, adjoining the Sierra Buttes mine on the west, on the same lode, has the cliff and ærial branches, but not the rose, as found in the Sierra Buttes mine—or rather, the rose is found, but it has no regularity or importance. The cliff and ærial have the same general characteristics here as in the adjoining claim, but they seem to be distinguished by the occurrence of regular pay chimneys in the cliff and of pockets in the ærial. If a pocket is found in the ærial near the hanging wall, the cliff opposite is rich on the foot wall. The work is confined chiefly to the cliff, which here has a yellow ribbon rock. The thickness of the quartz varies from 3 to 22 feet. A depth of 310 feet has been reached, and 800 feet have been run on the vein. There are three pay chimneys, the largest one 400 feet long horizontally. They are nearly vertical, but dip a little to the west.

There is two per cent. of sulphurets in the quartz; they contain on an average $75 per ton; and the superintendent says they are so magnetic that three-fourths of the particles will adhere to the magnet.

The total yield in 1866 was $108,000; the average yield per ton $10, and there is enough ore in sight of that quality to last three years.

The first mill, erected in 1856, began to run in February, 1857, and was burned down; the second mill was injured twice by avalanches of snow; the third mill, built in 1861, and now running, has 24 stamps, and is driven by two overshot wheels, each 32½ feet in diameter, both gearing into the same pinion-wheel, and both driven by the same water, one being immediately over the other. As the mill is 1,500 feet above the south branch of the North Yuba river, on a very steep hillside, thousands of stamps could be driven by wheels placed one below another on the steep ravine.

The mine can be opened 1,000 feet below the present working levels by tunnels. The ore now obtained is extracted through a tunnel, to which it is hoisted by steam. Amalgamation is effected in the mortar and on copper aprons, below which are blankets; and the tailings from these, after having lain a week to oxydise, are thrown into the battery, and it is supposed that $40 or $50 per ton are obtained from them. They are never worked separately.

In extremely cold weather not so much gold is obtained as in summer, and the loss is estimated at three per cent. Since 1856, $75,000 have been expended on buildings, $27,000 on flumes, and $5,000 on roads.

KEYSTONE.—The Keystone mine, 15 miles eastward from Downieville, has a lode from two to six feet wide, running east and west, and nearly vertical. The walls are of black slate, and the quartz is a yellow ribbon rock. There is no barren vein-stone, the walls pinching together at the ends of the three pay chimneys, which go down perpendicularly. A depth of 550 feet has been reached, and drifts have been run 500 feet on the vein. A tunnel, to be 700 feet long, has been started to strike the vein 300 feet below the present workings. It has already gone in 400 feet. The gold is fine and free and evenly distributed through the pay chimney, except one streak in the middle, which is the richest.

The seams in the quartz, instead of being parallel with the direction of the vein, cross at an angle. The average yield is $17 per ton, and 15 tons are crushed per day. The mill was erected in 1857, with eight stamps, and four were added in 1866, making 12 in all. The pulp is amalgamated in the mortar and on copper aprons, from which it passes over blankets, and the tailings from these are worked in Knox's pan.

PRIMROSE.—The Primrose, 3,700 feet long, is two miles north of the Sierra Buttes, on a vein which runs east and west, dips a little to the south, and is from 1 foot to 40 feet in width. The walls are hard and smooth. A depth of 150 feet has been reached, and drifts have been run on the vein 250 feet. There is one pay chimney, 50 feet long at the surface, horizontally, and 250 at the deepest workings. A 12-stamp mill was built in 1858, but is now so dilapidated that it should be rebuilt. The mine was in a paying condition, yielding $15 per ton, when the company purchased the adjacent Good Hope mine for $39,000, incurred a debt for payment with three per cent. interest, and undertook to work the latter mine, moving the mill to it. The expenses thus made overwhelmed the company, and mine and mill were sold for debt. The total yield of the Primrose mine has been $226,000, and it is generally considered in Sierra county a valuable mine.

MINES NEAR THE SIERRA BUTTES.—Chipp's mine, 1,100 feet long, near the Sierra Buttes, is on a vein three feet wide, with an east and west course. It has been worked irregularly since 1858, and the yield has been irregular, sometimes large and sometimes small. A depth of 200 feet has been reached. There is a four-stamp mill, which was built in 1858.

The Bigelow mine, east of the Sierra Buttes mine, and supposed to be on the same vein, has a four-stamp mill, which has been idle four or five years.

About 600 feet east of the Sierra Buttes lode, and near the mine of that name, was found in 1865 a pocket of gold in ochrous clay, with no vein-stone, but with well-defined walls. The pocket yielded $13,000 gross and $10,000 net. The yield was from $300 to $700 per day to the man while it was worked.

MINES NEAR ALLEGHANY AND MINNESOTA.—The Briggs quartz mine, half a mile above Minnesota, has a vein two feet wide, running east and west. An eight-stamp mill was built in 1863, and is now idle. The best yield of the quartz was $7 per ton, and the assay value about $20.

The French mine, one mile southeast of Minnesota, has a vein four feet wide, very rich in spots. A 15-stamp mill was erected in 1863, but is not running now.

The Rainbow mine, near Chipp's Flat, was found in a gravel tunnel 2,000 feet from the mouth, and from that an incline was run down the vein. The rock is rich, but the shaft incline is filled with water, and there are many disadvantages in working a mine situated like this one. An eight-stamp mill was erected in 1858, and has stood idle four or five years.

The Oak Flat mine, on Kanaka creek, one mile from Chipp's Flat, has a vein four feet wide running east and west. There are two tunnels, each 500 feet long, and work is now being done on the lower tunnel to open the mine. A four-stamp mill was built in 1862, was afterwards torn down, and is now to be rebuilt.

The Newell quartz mine, on Kanaka creek, one mile above Chipp's Flat, has a 10-stamp mill, which is standing idle, waiting for the opening of the mine.

The American Hill mine, four miles east of Minnesota, has a vein five feet thick on an average. A six-stamp mill, built in 1858, paid well for a time, but was sold for debt and has been idle for eight months.

The Union mine, in Wet ravine, one mile from Alleghany, has a pocket vein 18 inches wide. It has yielded $75,000, including $15,000 taken out in a hand mortar. There is an eight-stamp mill, which was built in 1864 and has been idle three or four months. The vein runs east and west, and the mine is troubled with water.

The Ironside mine, seven miles east of Alleghany, is reputed to be rich with refractory ore. An eight-stamp mill, built in 1864, ran two months and has since been idle.

The Twenty-one mine, on Kanaka creek, one mile below Alleghany, has produced little. A four-stamp mill built in 1866 is standing idle.

The Consolidated mine, on Jim Crow cañon, east of Alleghany, has a vein, but very little gold. A 16-stamp mill, erected in 1863, has been taken down, and is to be moved to a vein above Forest City. The Consolidated Mining Company of San Francisco spent $90,000 on their mine and mill.

MINES NEAR DOWNIEVILLE.—The Wheeler mill, near Downieville, is standing idle. It once had eight stamps, and now has but four.

The Gold Bluff mine, two miles above Downieville, is being opened by a tunnel. There is a 12-stamp mill standing idle.

The Kanaka mine, six miles east of Downieville, is standing idle, with a 20-stamp mill, the property of a New York company.

SECTION XI.

YUBA COUNTY.

The greater part of Yuba county is valley land, but the eastern end reaches to a considerable altitude in the Sierra, Camptonville being 4,200 feet above the sea.

The county debt is $200,000, and the State and county taxes together are $3 17.

The principal mining towns are Brown's Valley, Timbuctoo, Smartsville, Sucker Flat, and Camptonville.

CAMPTON, BROWN'S, AND HANSONVILLE.—Camptonville is an old channel which appears north at Brandy City, in Sierra county, and south at San Juan, in Nevada county. At Camptonville it appears near the top of a high ridge, and is nearly worked out. There are three hydraulic companies at work there, each using about 200 inches of water. The shipment of gold from Camptonville is now about $500,000 per year; seven years ago it was $700,000.

Brownsville, in the northeastern part of the county, had ravine diggings, which are nearly exhausted. There are now numerous orchards in the neighborhood.

Hansonville, four miles south of Brownsville, has some ravine and some quartz claims. About $10,000 have been taken out of quartz pockets in hand mortars. Seventy-five inches of water are used for irrigating vineyards.

YUBA RIVER.—The Yuba river, which was once lined with numerous large mining towns, has now been filled to a depth of 70 feet with gravel from the hydraulic mines, and the sites of all the river camps are now buried. There were 13 bars on the river within the present limits of the county, and all rich. At Parks's bar in 1852, there were eight companies at work in the river bed, with $218,000 invested in dams, flumes, pumps, &c., and with 200 hired laborers. The total number of voters was over 400, and the gold yield during part of the summer was about $10,000 per day. The Ohio Company took out $96,000 in the season; the Canal Company, $108,000; the Squaw Company, $60,000; the Excelsior Company, $89,000; the Patch Company, $60,000. The Canal Company in 1851 paid $150,000 dividends. These figures are derived from notes taken in 1852, by Lyman Ackley, esq., who was at that time State census agent for Yuba county.

THE SUCKER FLAT CHANNEL.—The leading mining district of the county is at Smartsville, which has Timbuctoo, a mile distant on the west, Sucker Flat, half a mile to the north, and Mooney Flat, two miles east. An old channel from 600 to 1,000 feet wide runs through Timbuctoo, Sucker Flat, and Mooney Flat, leaving Smartsville to the southwest. The bottom of this channel has not been worked for any distance, and therefore its course, whether to the southeast or the northwest, has not been ascertained, but it is presumed that it ran to the northwest. From Sucker Flat to Timbuctoo there is a ridge composed entirely of auriferous gravel, except a stratum of white cement, as it is usually called, about 150 feet below the surface. This cement is from 15 to 30 feet thick, and contains a little gold.

TIMBUCTOO.—The claims at Timbuctoo are the following, beginning at the west, and running eastward on the old channel:

Mr. Warren had an original location of 125 by 100 feet, but this was not large enough to justify the expense of the preparation necessary for hydraulic washing, and he purchased others adjoining, and the present Warren Company own 500 feet square, with a bed of gravel 130 feet deep. Forty feet at the surface are of gravel and boulders, then comes pipe-clay, 30 feet deep, and then a deep stratum of blue cement, which is richest near the bed rock. Drainage is obtained through an open cut, which with the flumes and other work and materials necessary for washing, cost $18,000. The supply of water is very irregular, but when it can be had, 500 inches are purchased at an expense of $75 per day. Labor, powder, and other expenses amount to $150 per day more, and the yield is $300 per day. About 10 men are employed. It is said that $60,000 have been paid for water to wash the ground of this company.

The Antone Company began work in 1853, drifting, and found very rich cement, which, when washed in a short sluice, paid them $50 per day to the hand, though much of the cement was not dissolved. A fence was built to hold the tailings, which after intervals were washed again and again, paying almost as well as at first. In 1854 they began to pipe, and the claim still yields well. They have paid $70,000 for water, which they cannot always get when they would like to have it.

The Union Company's history is very similar to that of the Antone. Their claim has been nearly as rich, and they have paid more for water.

The Michigan Company have a claim 1,000 feet long by 500 feet wide, which has been one of the most productive in the vicinity, the total yield having been $500,000, of which $150,000 have been paid for water, and $50,000 as dividends. The upper strata have been nearly all washed away, and the company are now running a tunnel to be 700 feet long, through which to wash the stratum next the bed rock.

After passing several claims, we come to the Babb Company, who have 500 by 400 feet. The surface of their claim has been washed off to a depth of 130 feet, yielding $250,000, of which $95,000 went for water. They have a tunnel 1,100 feet long, but it is so located that it gives a bank only 30 feet deep at the front. The late results, however, are very satisfactory. One clean up of 21½ days yielded $7,800; another of 19 days yielded $7,000; and a third of 22 days gave $12,000. They paid $90 a day for water, use 600 inches, and employ from 8 to 12 men. They own half of the Michigan tunnel, and the two companies will make alternate runs through it.

SUCKER FLAT CLAIMS.—The Blue Point Gravel Mining Company have a large claim at Sucker Flat, have worked it nine years, and have piped away half the area, 60 feet from the surface, washing through an open cut. They are running a bed rock tunnel to be 2,270 feet long and 110 feet deep. This enterprise was commenced in November, 1866, and will be finished in two years, at cost of $100,000. The depth of the gravel has not been ascertained precisely, so it is uncertain whether the tunnel will drain the claim to the bed rock.

The Union Company have a large claim, have washed off one-fourth of it to depth of 60 feet in one part and 120 feet in another. They are not piping now, and intend to tail into the Blue Point tunnel when it is finished.

The Blue Cement Company have a claim 500 feet long, by 240 feet wide, on which they began to pipe this year, with 20 men and 500 inches of water. Their present bank is 33 feet deep. They are now cutting a tunnel 30 feet deeper, and they expect to tail into the Blue Point tunnel when it is completed.

The Nevada Reservoir Ditch Company own about 100 acres, supposed to be all hydraulic ground, on the Blue Lead, near Sucker Flat and Mooney Flat, enough to last 50 years.

The O'Brien claim is 1,100 feet long on the ridge, and includes 30 acres. The present workings are 140 feet deep to the white cement, and the gravel is washed in a sluice 3,000 feet long. The quantity of water used is 600 inches; the yield from $150 to $250 per day, and the net profit $15,000 per year. A tunnel 210 feet below the present sluice, to be 800 feet long, and to cost $50,000, has been cut 260 feet, and will be finished in two years. This tunnel will be deep enough to drain the bed rock for some distance each way.

McAllis and Gordon have 700 feet of the ridge, and have lately completed a tunnel 1,500 feet long, at a cost of $40,000 to work the upper lead or the gravel above the white cement, and within 175 feet of the surface. Five years will be required to work off this upper lead. The distance from rim rock to rim rock across the channel in this claim is 1,000 feet. Seven men are employed, and 500 inches of water consumed. A tunnel to work the lower lead under the white cement will require three years' work.

The Taylor claim, 300 by 600 feet, is half worked out, and has paid very well, yielding with 600 inches of water from $300 to $400 per day, lately the latter sum. Six men are employed.

The Excelsior Water Company have a claim 600 by 1,000 freet, from which they have obtained $300 or $400, and sometimes $500 per day.

The Pittsburg claim is 2,000 feet long on the old channel, and is owned by an eastern company, which paid $300,000 in currency for it. They are now washing through a tunnel that cost $80,000, and the daily yield is reported to be $660, with 600 inches and 12 men. The present bank is only 30 feet deep, and a new tunnel, to be 76 feet lower, and 1,600 feet has been cut 400 feet, and two shafts have been commenced on the line, so as to have four additional working faces.

SMARTSVILLE BLUE GRAVEL.—The Smartsville Blue Gravel Company have a claim of about 150 acres at Sucker Flat. The channel is at least 200 yards wide, and its depth has never been ascertained precisely. On the bed rock lies a stratum of barren blue cement, 5 or 10 feet thick, containing large boulders of granite and slate. Next comes a stratum of hard blue pay cement, containing large boulders of slate trap and granite, a few pebbles, including some of quartz, and much quartz sand. It requires an experienced eye to distinguish this from the lower layer, but it is important to know their precise limits, for all of the pay cement is to be washed away, and all of the barren left in its place. Then comes a stratum of soft blue cement, 55 feet deep, softer on the northern side of the channel, and in places where the bed rock is lower than elsewhere. There are very few boulders in this stratum, and the pebbles are mostly of slate, and less than two inches in diameter. The largest gravel and the richest pay in this layer are found near the top. There are great variations in the hardness, but none is soft enough to pipe down.

The top stratum is fine red gravel, from 25 to 75 feet deep, softer than the blue, but still not soft enough to pipe. The pebbles are mostly of slate, greenstone, and quartz, the last very fine.

Many trees are found in the claim, some carbonized, others partly rotten, and partly replaced by sulphurets of iron. There are no petrifactions and no human bones or articles showing human workmanship.

Powder is used more extensively here than in any other hydraulic claim, probably more than in any other mine in California. All the strata are too hard to be piped down with economy, and some of them are so hard in places that the pipe would scarcely affect them. So much powder has been used here that its employment is reduced to a system. The quantity of powder for the blast depends upon the depth of the bank and the surface area to be loosened. If the bank is 50 feet deep a tunnel four and a half feet high and two and a half wide may be run in 75 feet; a cross-drift 60 feet long is cut across the end at right angles, and another similar cross-drift of equal length 55 feet from the mouth of the tunnel. 300 kegs may be used in such a blast, all distributed along in the cross-drifts and in the tunnel beyond the first cross-drift. 20 kegs near the intersection are opened by taking out the heads; the others are left closed, with the certainty that they will all be opened by the explosion of the 20. From the intersection to within 10 feet of the mouth wooden troughs two inches wide and deep inside are laid, and a liberal supply of powder is poured in, leading to an open keg. The 10 feet next the mouth are laid carefully with a fuse, and for that distance the tunnel is filled in with dirt. When the blast is fired a dull, heavy sound is heard, the earth rises slowly about 10 feet; it then settles down, leaving a dust behind it, and on examination an area about 120 feet square will be found all shattered.

By blasting, the water is enabled to carry off twice as much dirt as it would otherwise; and as 500 inches of water are used at an expense of $75 per day, there is a vast saving. The cost of powder is large, as about 10,000 pounds are consumed monthly on an average in this one claim. After the ground has been blown the pipes can bring down more than they can carry away, so about one-third of the water is allowed to run down over the bank, while the remainder is thrown through the pipes.

The portion of the claim worked is a hole 200 yards wide, 600 long, and 100 feet deep in the hill or ridge. The dirt from this hole has been carried off through a tunnel 1,700 feet long, and without a tunnel it would have been impossible to wash away the immense mass of gravel. At first a hole was washed 75 feet deep, and then another 75 feet deeper, and thus there is a bench in the claim.

For the sake of economy in washing it is customary to have three places to work upon at a time, so that after the pipes have been playing for two hours at one place they may be turned upon another, and the miners can then go and break up with their picks the large hard lumps which the water can neither break up nor carry off.

The sluices have a grade of 7 inches to 12 feet, and are paved with wooden blocks and boulders of basalt. The entire sluice is cleaned up once in four months, and half of it at intervals of two months. At the cleaning up clean water is run through so as to carry off the surplus dirt and gravel, and the water is nearly shut off. The false sides are taken off and washed with a little water. The wooden blocks in the bottom are set up edgewise, washed off, and taken out; 200 inches of water are turned on, and this cleans the dirt from the rock paving, which is taken out and put to one side. The sides of the flume are scraped and swept. Boards 10 inches high are fitted tightly across the sluice at intervals, and tough clay is put at the sides and bottom, so that no quicksilver, gold, or water can pass except over the top of the board. This is done before the rock paving is moved. Two hundred inches of water are now turned on, and all the gold, amalgam, quicksilver, black sand, and heavy gravel are collected above the boards. As they have three tons of quicksilver in the sluice at a time, and expect to find at least $40,000 of gold at a large clean-up, the operation requires some work. The usual time consumed in the cleaning up is 48 hours, and three days more elapse before the sluices are again in running order. There are three large clean-ups of about $40,000 each, and three small ones each of about $25,000, in a year. Thirty men are employed.

The total yield since March, 1864, when the claim became productive, has been about $1,000,000.

The report of 1866 gave a brief history of the claim and some details, which it is not necessary to repeat now.

Sicard Flat.—Sicard Flat, on the north bank of the Yuba river, two miles from Timbuctoo, has hydraulic diggings in a bed of gravel 90 feet deep. The best pay is in a bed of gray gravel from 4 to 10 feet deep on the bed rock, but none of it is rich enough to pay for drifting. The boulders are of trap, and seldom weigh more than 100 pounds. The widest part of the channel is 400 yards wide on the surface, but the bottom has not been reached on the northeastern side. There is not enough pressure to pipe well, and the dirt is not soft enough to dissolve entirely at the first washing; though in most claims it gets only one. In many claims tunnels and cross-drifts six feet high are cut at intervals of 8 or 12 feet each way, and in three or four days the pillars give way and the gravel above is well broken up by the fall. General rumor says that Sicard Flat has never paid.

The Lower Diggings claim, on the southwest end of the Flat, is 400 feet square, uses 600 inches of water in the spring, and employs nine men. The water is supplied by a ditch belonging to the claim. The yield for the season of 1866–7 was $13,000, and the expenses for the season were about $1,000 per month.

The Gates claim, 360 by 400 feet, and the Black claim, 200 by 400 feet, have not been worked for three years.

On the side of the ridge facing Parks's Bar is the McQueen claim, 800 by 400 feet, with a ditch carrying 600 inches of water belonging to it. This claim, when last worked, yielded no profit.

The Union claim has not been worked for six or seven years.

BROWN'S VALLEY.—Brown's Valley, 11 miles northeastward from Marysville, and about 500 feet above the level of the sea, is a rich quartz district.

The Daniel Webster Company have 3,600 feet on the Jefferson lode, have gone down 90 feet, and there stopped work three years ago. They are now reorganizing and preparing to start again.

The Pacific has 600 feet, went down 60 feet, and is doing nothing. The claim has been in litigation for five years.

JEFFERSON.—The Jefferson mine is 780 feet long on the Pennsylvania lode, which has yielded most of the gold obtained in Brown's valley. The vein runs north and south, dips 45° to the east with the course and cleavage of the slates, and has two main branches which unite at a depth of 360 feet in the Pennsylvania, and on the surface at the north end of that mine and at the south end of the Jefferson. The eastern branch has mostly bluish quartz, and is not distinctly traceable within 90 feet of the surface at the shafts of the Jefferson and Pennsylvania mines. The western branch has mostly yellowish quartz. Each branch in places is 10 feet wide or more.

The width in the Jefferson mine varies from 1½ to 14 feet, with an average of six or seven feet. The main incline is down 612 feet, and drifts have been run 400 feet on the vein. A fine pay chimney found near the northern line was 100 feet long at the surface, and 160 feet down, enlarged so as to be nearly 300 feet long horizontally, and maintained the same width to the 300-foot level, where it seemed to split.

The yield at the surface was sometimes as high as $40 per ton, and for small bodies of ore even rose to $200, but during the last four years has at no time exceeded $15. The following table shows the yield of the mine since it has been in the hands of the present company, for the several mine years ending December 1st:

	Receipts.	Labor.	Other expenses.	Dividends.
1863	$19,554 90	$8,926 75	$12,642 88	....
1864	121,380 05	54,794 56	28,596 17	$42,900
1865	88,197 60	28,063 73	12,406 69	42,900
1866	124,208 82	52,951 02	30,868 93	45,800
1867	56,275 67	46,419 51	6,654 47	....
Total	409,617 04	191,155 57	91,169 14	131,600

The year 1863, in the above table, began on the 13th September, when the company took possession; and the year 1867 comes down only to the first of October. Before September 13, 1863, the yield had been about $130,000, making the total production of the mine $539,000.

In 1,300 tons of ore there is one ton of sulphurets, which yield $220 of gold per ton.

The fineness of the gold at the surface was 840, and at 600 feet below it is 863 to 865.

The mill has 12 stamps and three Harney pans. About four and a half per cent. of the total yield is obtained from the pans. There are two engines, one of 60 and the other of 30-horse power. In this mill the scraps of iron found in the mortar, consisting of fragments from the shoes, dies, shovels, picks, hammers, and drills, are carefully saved, on account of the particles of gold driven into their interstices while they are battered about in the ore. From 20 to 50 pounds are collected in a month, and after being digested in warm sulphuric acid until a quarter of an inch is eaten off the surface, they yield about $3 of gold for every pound of iron. The larger scraps, before going into the acid, were broken up with a sledge hammer. The shoes and dies contained the gold chiefly on the face, and these, instead of being broken up and put into acid, were boiled half an hour in water, and then they were hammered and the particles of gold fell out of the interstices.

In a diagram the Pennsylvania shaft is shown running down into the ground claimed by the Jefferson. The two companies agree about their boundary line at the surface, but they have a dispute as to the direction of the line below the surface; and the Pennsylvania Company having taken some valuable quartz from the disputed ground, the Jefferson Company have sued them for $100,000, its alleged value. The main question in the suit relates to the direction of the vein. If the plane of the lode were vertical—that is, if the lode had no dip—there would be no dispute about the boundary line after the point of junction at the surface had been agreed upon, but this vein dips at an angle of 45°, and the direction of the boundary depends on the direction of the vein. If the vein runs with the meridian the boundary plane would be parallel with the equator. We have no express provision in our statutes relative to the legal point, but the courts will no doubt decide, when the question is raised, that the limit of a lode mine is a line made by a vertical plane passing through the vein at right angles to its horizontal direction. If a book is set up vertically on a table and another dipping at an angle of 45° is pushed against its side, the end of the sloping book will not fit against the other unless the two books meet at right angles. Put up two books sloping at 45° so as to touch at the upper corners, with a difference of 10° or 15° in their direction, and their ends will show how the boundary lines of mines run in different directions according to the course of the lode. The Jefferson and Pennsylvania agree at the surface, but 500 feet down there are 50 feet of vein in dispute between them.

PENNSYLVANIA.—The Pennsylvania Company, incorporated at Marysville, has 1,300 feet on the Pennsylvania lode and its branches, adjoining the Jefferson on the north; and it is supposed that several pay chimneys found on the latter mine dip into the Pennsylvania.

A depth of 600 feet has been reached on an incline, and drifts have been run 200 feet on the vein. Two pay chimneys are worked, and two others have been found.

The company commenced work in 1863, ran down 110 feet on the Pennsylvania lode, then struck across into the Jefferson, spent $75,000 before getting any return, and then spent $75,000 of the net receipts in opening the mine and building the mill. No dividend has been paid yet, and the $75,000 expended on the mine and mill have not been reimbursed. During the last ten months, according to the statements of the president of the company, the net yield above ordinary expenses has been $7,500 per month. The average yield at present is

$15 per ton; the amount crushed per month from 900 to 1,000 tons; the ordinary expenses $4,500, leaving $10,000 net per month.

There is one ton of sulphurets, containing $1,000, in 1,000 tons of quartz.

The mill has 16 stamps, is situated on the south end of the claim, and is driven by a steam engine of 100 horse-power. The quartz is hoisted by steam. Amalgamation is effected in the mortar and on a copper apron, below which are blankets, and the tailings from these are ground in four Chile mills. Wheeler and Randall pans are now being set up as preferable to Chile mills.

An experiment was made by grinding all the blanket washings from the 16 stamps, two hours for each charge, in the Chile mills, and the yield was eight ounces of gold in a month. Then half the tailings were ground, four hours to a charge, and the yield was 200 ounces in a month. Again, all the pulp from a four-stamp battery was allowed to run with a continuous charge and discharge through a Chile mill, and not one ounce was caught in two weeks. The ore was the same in quality and quantity, and the amount caught in the mortar during these experiments was the same per week.

In the middle of the Pennsylvania claim is an incline 180 feet deep, with pumping and hoisting works and a 15 horse-power engine. A railroad carries the ore from this incline to the mill.

In the Pennsylvania mill the Von Muller amalgamator, invented by the president of the company, is used. It is a box three feet long, a foot wide, and a foot deep, with a board set into the ends and going to within an inch of the bottom. Quicksilver, half an inch deep—about 80 pounds—is put into the box, which is then set under the sluice, below the amalgamating apparatus and the blankets. The pulp pours into the box above the board, has to pass under the board and then up, escaping over the lower side, which is not quite so high as the ends or upper side. This amalgamator requires little attention, and always catches enough gold to pay.

The Chile mills have cast-iron basins, cost $400 each, work a charge of 100 pounds in four hours, and make 10 revolutions per minute.

The Wheeler and Randall pans grind a charge of 1,200 pounds in four hours, and cost $500. Long grinding is very important for those ores in which the quartz is very fine.

Other Quartz Mines of Yuba.—The Burnside Company have 800 feet, went down 40 feet, but suspended work when the panic of 1864 came, and are preparing to start again.

The Paragon Company have 1,800 feet, did some work previous to the panic, and have done nothing since.

The Ophir Company have 1,200 feet, and have had the same history as the Paragon.

The Rattlesnake, formerly the Yuba mine, is 1,600 feet long. The vein is two and a half feet wide, and a depth of 140 feet has been reached. There is a 30 horse-power engine for hoisting. A yield of $18 per ton was obtained from 1,500 tons. The company are preparing to build a mill.

The Dannebroge mine, 2,400 feet long, is on a lode which runs northeast and southwest, and intersects the Pennsylvania lode at the north end of the Pennsylvania mine. The vein is three feet wide, and it dips to the northwest at an angle of 40°. Only one pay chimney has been discovered, and that is 150 feet long, horizontally, with hard white flinty, quartz, containing many fine specimens, and averaging $15 or $20 per ton—the richest in Brown's valley. The total yield was $250,000, according to report, but the company has had much litigation and has kept its affairs as secret as possible. Rumor says the superintendent had instructions to keep no books. Work was stopped in 1865, and was resumed in July of this year. A depth of 500 feet has been reached, and drifts have been run 200 feet on the vein. There is an eight-stamp mill, with two Chile mills and an engine of 20 horse-power.

Half a mile west of the Pennsylvania mine is the Sweet Vengeance, 8,400 feet long, on a lode which runs northwest and southeast, and dips 40° to the northeast. They commenced work in 1863, spent $80,000, extracted $25,000 from the mine, and stopped work two years ago. Many rich specimens have been obtained from the mine, and for six months it paid expenses. A depth of 200 feet has been reached; drifts have been run 250 feet on the vein; and there is a 20-stamp mill.

The Bayerque claim, one mile east of Brown's valley, has reached a depth of 100 feet, and has quartz that yields $18 per ton. Some of the rock has been crushed at the Dannebroge mill.

On the same lode is the Anderson mine, which is being opened. The quartz is rich in sulphurets.

West of Brown's valley, at Prairie diggings, are hundreds of quartz claims, which were prospected a little in 1863 and abandoned in 1864.

At Dobbin's ranch is the Bateman mine, which has a vein 18 inches wide, and yields $30 per ton. There is a five-stamp mill, which began work in July of this year.

At Frenchtown, in a ravine between two steep mountains, there are many quartz veins, but no mill.

The Brown's Valley Tunnel Company undertook to run a long tunnel into the hill back of Brown's valley for the purpose of prospecting 19 quartz veins which crop out on the hill, but they were stopped by the panic of 1864, after going 200 feet.

The Marc Antony claim, a quarter of a mile west of Timbuctoo, had a pocket that paid $5,000 to a hand mortar, and nothing has been obtained since.

The Andrew Jackson quartz mine, near Smartsville, has a 10-stamp mill, which is not running. The vein is now being opened.

The Deadwood lode, one mile from Forbestown, and very near the Butte county line, is four feet wide, and has yielded $5,000 in hand mortars. Three tons taken out near a pocket, and worked in a mill, yielded $30 per ton. It is supposed that there is little beyond the pockets in the lode.

Brown's Valley Quartz Regulations.—The records of Brown's Valley district have not been kept carefully, many alterations have been made in the regulations, and there is much doubt as to what regulations are in force. The requirement of representation at annual meetings is peculiar.

On the 14th of February, 1853, a meeting was held "to make new laws to govern the mines in said valley in regard to working and holding claims." The following resolution was passed at that meeting:

> *Resolved*, That the law passed February 14, 1852, and all laws previous to that date regulating the working of quartz claims in the above valley and vicinity, is an arbitrary and despotic set of laws, and are this day revoked by common consent.

Nothing was done at that meeting to fix the size of claims, or the conditions under which they could be held. A clause adopted at this meeting requiring the posting of a notice on the claim of any company or individual at the time of location was repealed on the 31st of July, 1853. On the 8th of August, 1853, the following resolutions were adopted:

> *Resolved*, That each claim shall be entitled to a vote in the miner's meetings in this district, by the proper owner, or represented by power of attorney from the proper owner, specifying the object of that power and its limitation.
>
> *Resolved*, That each claim, in the future semi-annual meetings of this district shall be represented in person or by a written power of attorney, otherwise it shall be forfeited.

At a meeting held on the 14th of August, 1854, W. Kinsella moved that all claims that had been worked since the last meeting should be exempt from the necessity of being represented. The motion was lost.

At a meeting held on the 4th of January, 1864, the following resolutions were adopted:

Resolved, That the law requiring each shareholder or claimant in a company to represent his individual interest be, and is hereby, expunged from the record.

Resolved, That any known member of a company shall have full power to represent and cast a vote of said company to the number of feet therein contained, on all questions pertaining to the mining laws of Brown's Valley district.

On the 2d of January, 1865, the following resolution was passed:

Resolved, That for the better regulation of working claims, from and after this date it will only be necessary to perform or make improvements on any quartz claim during the year to the amount of $100, in order to hold the same, and after such work has been done, the representation of claims annually will be sufficient to hold the same, and all parties after having performed such labor or improvements shall leave a written notice to that effect with the recorder of the district, the same to be placed on record. Any claim that shall have performed such amount of work shall be considered exempt, providing said work was done within the past year.

On the 8th of January, 1866, the following resolution was offered by Charles Bandum:

Resolved, That for the better regulation of claims, hereafter any and all claims shall have at least $5 worth of work or improvements performed on each and every claim of 150 feet every year, in order to hold the same.

H. Videau moved to amend by saying $20 instead of $5. The amendment and resolution being put to vote were both lost.

Mr. Bandum moved to reconsider, and the motion was carried.

It was then moved by H. Leland to amend H. Videau's amendment by having $10 worth of work or improvement performed on each and every claim of 150 feet annually in order to hold the same, in addition to the annual representation, and that a sworn certificate of such work or improvement must be recorded with the mining recorder of this district, and that unless such certificate be recorded that such work has been done, then such claim or claims shall be forfeited. The amendment was then put and carried.

There is no record that Videau's amendment, or Mr. Bandum's resolution, was put to a vote.

By a resolution adopted January 3, 1859, it was declared that quartz claims should be 150 feet on the vein, with all the dips, angles, and spurs.

On the 7th of January, 1867, the following resolution was adopted:

Resolved, That the law requiring work, improvement, or labor to be performed on claims, be dispensed with, and that representation be sufficient to hold the same, running until the first Monday of May, 1868.

The following is a copy of a certificate of representation, on record:

I do hereby certify that I am the agent and part owner of the Brown's Valley Gold and Silver Mining Company, situated in the Brown's Valley mining district, Yuba county, California, and that the representation, &c., of the same has been duly performed according to the district laws for the years 1864 and 1865.

G. H. LELAND, *Agent.*

JANUARY 29, 1866.

EMPIRE QUARTZ REGULATIONS.—The Empire district, near Smartsville, has the following regulations:

Notice of a claim or location of mining ground by individual or by a company, on file in the recorder's office, shall be deemed equivalent to a record of the same.

Each claimant shall be entitled to hold by location 200 feet on any lode in the district, with all its dips, angles, spurs, offshoots, outcrops, depths, widths, variations, and all minerals and other valuables contained therein—the discoverer of any, or locater on a new lode, being entitled to one claim extra for discovery.

The locater of any lode or ledge in this district shall be entitled to hold on each side of the ledge, lode, or lead, located by him or them, 250 feet, including any lateral veins, lodes, or ledges, bearing minerals therein. The space of said 250 feet on each side of the main lead shall be considered as claimed by, and entirely belonging to, the locater or locaters of a ledge, and his or their assignee, and parcel of the same mine.

It shall be the privilege of any person or persons or company, when the vein ledge or lode of mineral is not distinctly traceable on the surface, to take up the ground they desire to prospect, stating in their notice the manner they intend to prospect the same.

Every claim, whether by individual or company, shall be recorded within 10 days after the date of location.

It shall be required of each company holding ground in this district to put $50 worth of work on said ground in three months from the date of recording.

When any company shall have done honest work to the amount of $100 upon their claims, and shall cause an entry to be made on the records of this district, said company shall be considered as having acquired a vested right in said ledge, which shall have all the force and effect in law and equity as other real estate and property.

When any company has put work to the amount of $50, said work shall hold said claim for one year.

These regulations were adopted January 26, 1863. No quartz mines are now worked in the district.

SECTION XII.

BUTTE COUNTY.

Butte is a large county, which includes part of the basin of the Feather river, and reaches from the Sacramento river eastward to a line where the tops of the ridges are about 4,000 feet above the sea. The western part of the county is in the lowland of the Sacramento valley, and a majority of the people are engaged in agricultural pursuits. The higher portions are densely covered with pine forests, on which most of the California turpentine and rosin have been made.

Oroville, the county seat, is connected by railroad with Marysville, and the latter place will soon be connected with Sacramento.

The county debt of Butte is $280,000, and the State and county taxes, $3 30 for the current year.

Feather river was extremely rich in early days, but it is now worked out; or, at least, no extensive fluming or damming enterprise in the river has paid within the last eight years.

The town of Oroville stands on a bed of auriferous gravel which may pay for washing at some day.

BUTTE TABLE MOUNTAIN.—The most prominent topographical feature of Butte county is the Butte Table mountain, which rises at Lassen's peak and flows down as a river of basalt to Oroville, where it terminates on the north bank of Feather river, which it never crossed, or else all south of the stream has been swept away, unless certain peaks near Bangor are remains of it. The course was nearly south, and its general elevation above the plain near Oroville is 1,000 feet. The width averages about a mile, but there are places where branches extend a considerable distance to the westward. The surface declines about 100 feet in a mile to the southward and about 50 feet to the mile to the westward. Is this inclination to the westward due to the accidental wear of the surface by the water, or is it caused by the upheaval of the Sierra? The inclination of 50 feet in a mile to the westward, observed near Oroville, may not be found along the whole course; but if it marks the entire length of the basaltic stream, it would imply an uplifting of the eastern side.

This Table mountain, like the similar one in Tuolumne county, covers the bed of an ancient auriferous stream, but it is neither so rich nor has it been worked so much as the other basalt-covered river.

CHEROKEE.—The principal mining camp on the Butte table mountain is Cherokee, where the basalt has been denuded for a distance of four miles, giving miners an opportunity of getting down to the auriferous gravel. The strata here, according to the observations of Charles Waldeyer, esq., are the following, commencing at the top: basalt, 80 feet high; pipe clay and sand, 10 feet; boulders burned and vitrified, 12 feet; sand and clay mixed with quartz gravel, 20 feet; pipe clay, 12 feet; white quartz gravel, 150 feet; pipe clay, 12 feet; white and yellow quartz gravel, 100 feet; sand, 15 feet; white and yellow quartz gravel, 200 feet; pipe clay, 30 feet; quicksand, 10 feet; white quartz gravel and sand, 10 feet; reddish quartz, 10 feet; blue gravel, from 5 to 40 feet. The denudation at Cherokee is from 300 to 500 feet deep, in some places reaching to the top of the upper layer of white and yellow quartz gravel, and in others reaching down to the middle of the second. In no place is the gravel less than 200 feet deep in the middle of the channel; that is the presumption, for the bottom of the channel has not been reached; but the miners generally suppose that the lowest workings are very near the bottom. The rim-rock rises about 150 feet above the bottom of the channel, and is not cut through to the bottom anywhere by cañons.

The diggings at Cherokee have been worked since 1850, and have always paid moderately well, but there has never been enough water. Most of the claims are suitable for the hydraulic process. The gravel and gold bear much resemblance to those found at Smartsville.

Oregon Gulch Gold Mining Company.—This is an extensive placer mine, situated at the head of Morris Gulch. The basalt, of which Table Mountain chiefly consists, covers an ancient river bed, extending from Cherokee Flat in a southwestwardly direction for a number of miles, until it is lost in the Sacramento valley. When the eruption occurred in this locality, the bed of the ancient river was the lowest portion of the country. The basalt, occupying the river bed, forced the water into new channels, which, in process of time, wore the surrounding country down to its present level. Being of an indestructible nature, which almost absolutely resists the action of the elements, it protected the bed of the river from denuding agencies, and we thus find the river bed in almost exactly the same condition as when it was overwhelmed by lava in remote ages.

The exceedingly regular grade of the surface of every portion of this lava flow not undermined by the action of water proves that the country has not been subject to any great upheaval.

In the course of time the Sacramento river formed its valley and the Feather river cut its channel through the rocks towards the mountains, leaving the ancient river beds over a thousand feet above their present levels.

Morris Gulch commenced at the Feather river, and cut its course to the north into the ancient river channel, gradually wearing away the bed rock, and causing vast slides of rock, gravel, sand, and the basalt cap into its cañon, where, in process of ages, all was reduced and carried into the Feather river in the form of sand and gravel. This gulch cut through the richest portion of the ancient gravel bed, and a large part of the gold remains in the gulch, rendering it one of the richest gulches in California.

Oregon Gulch was enriched from the same source.

Shirmir Gulch, on the west, did not reach the gravel in the old river bed, or at least that portion which contains the pay streak.

Wherever this has been worked it has proved rich, as just north of Oroville, at the head of Morris Gulch, and at Cherokee Flat for a distance of over 10 miles. Its width is not definitely known, but at the head of Morris Gulch it must be over a mile. At Cherokee Flat, and near Oroville, the miners follow down the bed of the ancient stream, and in a short distance the water, having no outlet, becomes very troublesome, and will in time prevent work from that direction. But at the head of Morris Gulch the miners follow up the stream, and the water drains off and does not interfere with their labors.

This appears to be almost the only point where sufficient fall can be obtained for a good "dump" for hydraulic mining. "Dump" means a sufficient declivity from the end of the flume to cause the tailings or debris from the mine to run off in natural channels and not accumulate at the end of the flume. This is very important. Unless a mine has a good dump, it cannot be worked by hydraulics to any advantage.

The Oregon Gulch Gold Mining Company are at work at present on a large slide, and still have a good dump. But when they follow the lead under the basalt, they will find the bed rock much higher than where they are now at work. This will give them an excellent dump, sufficient to wash all the gravel under the mountain up to Cherokee Flat. The indications are that they are at work on the western side of the lead or pay streak, and as they follow into the mountain they will get nearer its centre, where the gravel will probably be richer than where they are working at present, and much more water will be met with. This will be a great assistance in washing the sand and gravel. Except in an abundant supply of water at all seasons of the year, the natural facilities for working this claim are superior to those of any other claim of a similar nature in this vicinity.

They have been turned to good account by the manager of the company, Mr. William Hendricks. All the work has been done in a thorough and miner-like manner. The position of the company's flume is lower than any other in this locality, so that, as the work progresses, all the water in the mountain must pass through it; this is important, as the use of the water in the mountain will be of great value.

The scarcity of water in the dry season will only delay the working of the mine. If water should be brought in by a ditch company, work could be continued during the whole year, which would be a great advantage, but this would in a measure be neutralized by the cost of the water.

The expense of bringing water to a desirable point, either by pumping it up from the river or by iron pipes, is so great that it is difficult to see any profit in the enterprise, unless the mine owners in the mountain should bring it in for their own use.

These mountain claims are among the most enduring placer mines in California. This ancient river bed is as rich as the bed of Feather river; and a company owning half or a whole mile of the Feather river bed, as rich as it was before it was worked, would have possessed one of the most valuable mines in the world. The cost of working the old bed under the mountain will not be greater than that required to flume and drain Feather river.

The climate is mild and healthful. Mining operations can be prosecuted at all seasons of the year. Being within four miles of the terminus of the Marysville and Oroville railroad, labor and all supplies required in mining can be obtained as cheaply as at any other mining locality in California.

THE CHEROKEE BLUE GRAVEL CLAIM.—The Cherokee Flat Blue Gravel Company have a claim a mile wide across the mountain by two miles long on its course, south of Cherokee. They have been trying to get into the channel, but have not yet succeeded. They started a low tunnel, which ran into trap rock so hard that work was stopped, and then a shaft was sunk 155 feet deep, and the water became so troublesome that that had to be abandoned; and then an incline was commenced, and that has reached the red gravel, which is supposed to rest on the blue cement. The claim is probably very valuable, but much time and money may be required to open it. The company is incorporated in San Francisco. A steam pump is used for hoisting water from the incline. The claim has been worked since 1856, and the present company have spent $70,000. The blue cement supposed to be on the bed rock, where it has been reached, has yielded $8 per day to the hand, when worked under great inconvenience, and has been soft enough to be washed in a sluice without crushing.

THE EUREKA CLAIM.—The Eureka Company cut a tunnel 900 feet long, and, after nine years' work, got into gravel, but did not succeed in making enough to repay them for $40,000 expended. They are not at work now. The tunnel is 106 feet below the top of the rim rock.

The Cherokee Claim.—The Cherokee Company, who have a piping claim in the flat, took out $54,000 in 50 days' washing in 1866: from a stratum seven feet deep, 100 feet wide and 300 feet long. The company own 50 acres, have piped away about six, have expended $150,000, and have extracted $500,000. They had water to wash 60 days this year, and in one dry season they could wash only 10 days. It is to be presumed from the yield of the small part of their claim already worked, that if they had an abundant supply of water they might produce more than any other placer claim in the State.

Welch & Co., adjoining the Cherokee Flat Blue Gravel Company, have a claim 100 feet square, from which they have taken $25,000.

Diamonds.—Cherokee has been notable for the production of diamonds, a number having been obtained here. They are mostly found in the red gravel next to the blue cement at the bottom of the channel. This "red gravel," as it called, is a stratum of tough red clay enclosing pebbles of various kinds, mostly quartz and green-stone. The gems have not been observed in this stratum, but after portions of it have been washed, they have been picked up in the sluice. Some persons have spent days and weeks in hunting for diamonds, but without avail. They are not sufficiently numerous or valuable to pay for a special search. The metal in the red gravel is more valuable than the stones. If at some future time there should be an opportunity to wash much of this stratum, attention will no doubt be given to the diamonds, which might, under favorable circumstances, be obtained in sufficient quantity to reward the extra care required in collecting them. Those found at Cherokee are nearly all clear, and so brilliant at the surface and so regular in their crystallization, that no doubt of their character could remain in the mind of any one familiar with the natural form.

Morris, Nimshew, and Kimshew.—Between Cherokee and Oroville Morris ravine has cut deep down into Table mountain, and has washed away much auriferous gravel, but has not enabled the miners to get fairly into the channel, though they have spent much money in attempting to get in. The ravine claims were very rich.

Nimshew and Kimshew are places north of Cherokee where tunnels have been run in to strike the old channel under Table mountain, but they have not paid much.

Bangor.—Bangor is 12 miles southeastward from Oroville on an old channel, the bed of which is about 60 feet below the level of the lowest ravines in the neighborhood. At the bottom of this channel is a deposit of hard blue cement, about 60 feet wide and six feet deep. In this cement are found boulders weighing several tons, and the gravel is green-stone, trap, granite, slate, and quartz; the last being not more than one-eighth of all the gravel. The stream seems to have been about as large as Feather river, and to have run toward Oroville with a grade of five feet in 100. Over the pay stratum there is a barren grayish cement, softer than the blue.

This channel was discovered in 1857 by some placer miners, who, while running a cut in a ravine, found the bed rock dipping down, and after following it as far as they could in the cut, they went off some feet and sunk a shaft, which in 65 feet struck a rich stratum, which paid $100 per day to the hand. The existence of a channel being proved, the outcroppings of the rim rock at the ravines and on the hill-sides showed its course, and it was claimed for miles. The pioneer claim was known as Boyle's.

The claim in which the channel was next opened was that of Tucker, to the southeast. This claim was worked three or four years, but did not yield much profit, the pay stratum being found for a distance of only 200 feet.

The Floyd claim, adjoining Tucker, the third in reaching the pay, was worked for a year and half, in which time the pay dirt was exhausted. The cement was so tough that it was washed eight or nine times, and was not entirely dissolved then. The yield from the first five washings was $46,500; the expenses $14,500;

the dividends $32,000. About $23,000 was obtained from the first washing; as for the production of the washings after the fifth, no information could be obtained, but it was probably quite small. This claim was 300 feet long, and pay was found for a length of 220 feet in the channel. The shaft reached the pay in April, 1858, and it has been customary to wash the dirt every spring.

Next to Floyd's was the Oroville claim, 600 feet long. It was worked by three shafts and paid well for several years. Common report says the bed rock was not well cleaned.

Between the Oroville and Boyle claims the channel did not pay in any place, though many shafts were sunk. Southeast of Tucker's nothing was found, and it is doubtful, according to some miners, whether the channel was struck.

The Barnum claim, northwest of Boyle's, is 1,500 feet long, and was opened in 1861 by a shaft, which struck the pay stratum at a depth of 55 feet. Two hundred feet of the channel were worked out in a year and a half, and the dirt was washed three times in a sluice 300 feet long. The first washing, immediately after the cement was extracted, yielded $8,000; the second, a year later, gave $2,000; and the third, after an interval of two years, yielded $1,500. The dirt is not fully washed yet, and it is saved to be put through the sluice again. Two other shafts have been sunk, but nothing has been taken out of them as yet, though good prospects have been found in one of them. Several companies are prospecting for the channel northwest of the Barnum claim.

CEMENT BARREL.—At the Barnum claim Mr. E. Bassett has been trying to reduce cement in a barrel eight feet long and three feet in diameter, made of boiler iron. An iron pipe runs through the barrel, passing through hollow journals, and through this pipe exhaust steam from the engine is to pass, so as to heat the cement. There are two doors opposite to each other in the barrel, each 10 by 14 inches, for charging and discharging. A ton of cement, 10 pounds of quicksilver, and 60 gallons of water will be a charge, and when the door is fastened down the steam will be turned on; the barrel will be set to revolving at the rate of 20 revolutions per minute. In 20 minutes the cement will be at boiling heat, and in 50 minutes it will all be disintegrated. One hour will be required for a charge, including charging and discharging. There is no doubt that the cement can be disintegrated in this manner, and the expense does not exceed 25 cents per ton. The barrels are lined with wood set endways, two and a half inches thick.

WYANDOTTE.—Wyandotte, sixteen miles west of Forbestown, has some ravine claims, half a dozen hydraulic claims, and an ancient channel, the same that is worked at Bangor. This channel is 50 feet below the level of a creek that passes Wyandotte, and thus there is no natural drainage, and the blue cement at the bottom of the channel is not supposed to be rich enough to pay for pumping. Several shafts have been sunk to the bottom, striking the channel. The hydraulic claims at Wyandotte have banks 75 feet high, and take 40 inches of water each on an average, with a pressure of 75 feet. There is a large body of this gravel. A thousand inches of water are purchased here, a small portion of it for irrigating orchards and vineyards, but mostly for shallow mining.

FORBESTOWN.—Forbestown, 22 miles eastward from Oroville, on the main divide between the Yuba and Feather river, and on the main road between Oroville and La Porte, has quartz and placer mines, lumbering and turpentine-making among its resources.

The town was in its most flourishing condition in 1855, when it polled about 400 votes, and now it polls only about 100.

The shipment of gold from Forbestown in 1866 was $135,000; from the 1st September, 1866, to the 15th July, 1867, it was $80,121.

There are a number of springs on the ridge near Forbestown, all about the same level, and all have cold water. No town in the State has so large a supply of cold and good water from springs above the level of the main street.

In Robinson's hill, near town, there are a number of quartz veins, most of them small, and many of them visibly auriferous.

New York Flat is the principal mining district near Forbestown. Three hydraulic claims are at work there now, employing in all about 20 men. In 1866, four companies there took out $50,000.

There has been some difficulty about drainage, and the Nevada Company are making a deep cut to be half a mile long, and to drain a body of ground 4,000 feet long and 300 feet wide, supposed to be rich.

MOOREVILLE AND EVANSVILLE.—Mooreville, in the southeastern corner of the county, has a large body of auriferous gravel, in a good position for piping, except that it is difficult to get water high enough. There was a ditch which was too low down, and it has now gone to ruin. A new one to be 60 feet higher has been commenced, but no work is being done at it now. Some doubt is entertained whether the gravel is rich enough to pay for washing.

Evansville, four miles southwest of Forbestown, purchases 200 inches of water, some of it for mining and some for irrigation.

BANGOR QUARTZ REGULATIONS.—Each mining district in Butte county has its own quartz regulations.

The regulations of the Bangor district contain the following provisions:

ARTICLE 2. The size of a mining claim in this district shall be as follows: for ravine or surface mining a hundred yards square, provided that a ravine claim shall extend from bank to bank; for blue lead claims a hundred feet in length and extending from rim to rim; for quartz or other mineral-bearing rock 200 feet on the lead with its spurs and angles, and 100 feet on each side of said lead, with sufficient ground adjacent thereto for the erection of the necessary works.

ART. 4. Persons locating claims in this district shall post in one or more conspicuous place or places thereon a notice containing the number of claims, with the names of the locaters and a general description of the ground claimed, with the boundaries thereof, and within 10 days thereafter file with the district recorder, hereafter to be provided for, a general description of said claim, with the boundaries thereof sufficiently distinct as to be easily found by reference to the record, which record and notice shall be *bona fide* proof of possession of said claims for the space of 90 days from date of record thereof.

ART. 5. After the expiration of the 90 days mentioned in the previous article, all claims shall be deemed abandoned, unless the parties locating the same shall proceed to work them in good faith, and by expending in labor and improvements at least $5 per month for each 100 feet claimed until the amount so expended shall amount to $60 for each 100 feet of the whole amount claimed.

ART. 6. Parties having complied with articles four and five shall be entitled to hold their claims without further expense for two years.

FORBESTOWN MINING REGULATIONS.—The mining regulations of the Forbestown district now in force were adopted on the 9th June, 1863, and 48 quartz claims are recorded in the district.

The following are the main provisions:

The size of an individual claim on gold-bearing, silver, or other mineral veins shall be 100 feet in length on the ledge vein or lode, including all lateral spurs, angles, variations, and intersecting veins, with a width of 200 feet on both sides of the ledge.

When there is conflict in boundary, or as to location, the claim or claims first located shall have priority of right; location and property and the claim subsequent in date, if it is a lateral interference, may be extended by expansion on the other side, if desired, provided the same does not interfere with a prior location.

Every claim located in this district must have good, substantial notices, specifically setting forth the direction, nature, and extent of the claim, posted at each end of the same in some conspicuous place, and a copy thereof filed in the office of the recorder within 10 days thereafter.

Each quartz mining company who have claims in this district, upon which $50 worth of work shall have been expended, must be worked upon in good faith at least two in every 30 days by the company holding said claims, and all ground which shall not have been so worked within 30 days shall be deemed vacant ground and subject to location the same as though it had not been located. Those claims on which work to the amount of $50 shall be done may be held by the claimants for the period of six months after work shall have been stopped on the same, when the claim shall be considered abandoned.

The size of a placer or ravine claim shall be 100 feet in length, running up and down the ravine, and the owner or owners of said claim or claims can work the same as wide as he or they choose, and if a quartz lode runs across the placer claim the owner of the same shall be entitled to 100 feet of the quartz lode, 50 feet on each side of the main or deepest channel running through his claim.

NISBET QUARTZ MINE.—The Nisbet Mining Company, incorporated in Marysville, has a mine 3,600 feet long on a vein which runs north and south, dips 50° to the east, and averages two feet in width at Oregon City. The walls are of slate. The main shaft or incline is down 160 feet, and drifts have been run 700 feet on the vein, in pay all the way. The lode varies in thickness from six inches to nine feet; in very narrow places sulphurets form one-tenth of the vein, and in the widest not more than a hundredth. The sulphurets assay from $1,300 to $1,600 per ton; are caught in a sluice and are saved to be worked at some time in the future. The mill has eight stamps, and there is a six-inch pump for drainage, all driven by steam. Work was commenced on the mine with arrastras in 1851, and the present mill was built in 1864. The yield at the surface was $34 per ton; and of late it has been $10, exclusive of the sulphurets, for the reduction of which no arrangements have been made. Thirteen men are employed; nine white men and four Chinamen. The latter are considered better feeders because they do not become impatient and dissatisfied with the monotony of the labor.

SPRING VALLEY.—The Spring Valley mine, a mile and a half east of Cherokee, is on a vein which runs north and south, is seven feet wide, and is nearly horizontal at the surface for 200 feet, and dips 50° to the east. The claim is 300 feet long. There was a 10-stamp mill which crushed several thousand tons of rock, and extracted, according to report, from $10 to $24 per ton. The mill was burned down and work ceased on the mine, but lately work has been resumed, but there is no new mill as yet.

OTHER QUARTZ MINES OF BUTTE.—The Powell mill, at Oregon City, has 12 stamps, and has been idle a year.

The Rock River mill, which stood between Oregon City and Cherokee, has been removed. There was a roasting furnace attached to it.

There is a five-stamp quartz mill at Mount Hope, not running.

Three quartz mills at Yankee Hill have been burned down—the Yankee Hill, the Virgin, and the Fuller.

Derrick's quartz mill, at Oregon City, was taken across the mountains in 1863, and stays there.

White & Nutter's mill, at Oregon City, was moved away in 1866.

The Bloomer Hill mill, 14 miles north of Oroville, has eight stamps, and is now running, but the mine is pockety, and the yield is very irregular.

Near Lovelock's, seven or eight miles above Dogtown, an arrastra is running.

Smith & Sparks's mine, two miles and a half northeast of Oroville, is on a vein four feet wide, running north-northwest, and dipping northeast. The walls are of slate. The mill has eight stamps, was built in 1865, and rebuilt in 1864. It has been standing idle for two years. The owners are mostly San Franciscans.

The Forbestown Mining Company own 15,000 feet in 9 or 10 claims, on different lodes. Mexican lode No. 1 is five feet wide, and has yielded $20 per ton for 100 tons; and Mexican lode No. 2 is 12 feet wide, and has yielded $10 per ton for 200 tons. There is a five-stamp steam mill which has not been used except for prospecting purposes, and is now standing idle.

The Shakspeare mine, 3,000 feet long, has a vein 12 feet wide and has been opened by a small shaft. Ten tons yielded $10 per ton.

The Polecat lode, one mile from Forbestown, is two feet wide, and 100 tons of its quartz yielded $1,200.

SECTION XIII.

PLUMAS COUNTY.

Plumas county comprises the more elevated portion of the basin of Feather river. It is high, rugged, and wild. Lassen's Peak forms the northwestern corner, and that was a great centre of volcanic energy, from which lava and scoria were poured or blown out upon the adjacent country. The ancient rivers which appear at Montecristo and at Brandy City, in Sierra, ran through Plumas, but their course has not been traced so distinctly, nor have they been worked with so much profit. In most places where the channels have been found, they are covered so deep with volcanic matter, and the pay stratum is so difficult of access, that the profits of working have been moderate. On the other hand, there is reason to believe that many extensive gravel deposits in this county will be worked at a profit within a few years, and that gravel mining will make more progress here for years to come than in any other part of the State.

The county is very rich in quartz, and American valley and Indian valley are two of the main centres of quartz-mining industry in California. There are many rich veins of copper, but they cannot be worked with a profit at present. At least, none has yielded any profit, although one is being worked now.

The principal placer-mining camps, all on old channels, are La Porte, Secret Diggings, Gibsonville, Saw Pit Flat, Little Grass Valley, Onion Valley, Washington, Hungarian Hill, Badger Hill, Eagle Gulch, Grizzly Creek, and Spanish Ranch.

The quartz veins in Plumas generally run east and west, and dip to the south at an angle of 45°.

Beckwourth's Pass.—Plumas county possesses in Beckwourth's pass the lowest across the Sierra Nevada; but it is not in the direct line of travel between Sacramento and Virginia City, and therefore it is not much used. The elevation is 4,500 feet above the sea, and the latitude 39° 50′. The pass proper is two miles long, and for 12 miles the road has an elevation of more than 4,000 feet above the sea. Last winter the snow, at the deepest, was two feet and a half on the summit—not enough to interfere seriously with travel, even if nothing were done to beat it down. Heretofore the road west of Quincy has crossed a ridge 6,000 feet high with 18 miles of snow-belt, but a road is to be constructed down a cañon, so that there will be a continuous descent from Quincy (which is 3,400 feet above the sea) to Oroville; and then there will be no more trouble from snow. The last legislature authorized Plumas county to issue bonds to the amount of $65,000 to aid in the construction of a road along the north fork of Feather river to Beckwourth's pass, and a company has commenced work. The first 30 miles out from Oroville are to be on railroad grade; and the whole work is to be finished in 1868, at a cost of $140,000. The superiority of this route for wagon travel, in every respect save distance, is admitted by all persons familiar with the different passes over the Sierra.

Conly and Gowell's Claim.—Conly and Gowell have a very large claim at La Porte, made up of 100 original claims. It includes the entire old channel 500 feet wide, and extends into the hill half a mile or more.

During the water season they use 3,000 inches of water, at least so long as they can get so much; they employ 50 men, and so anxious are they to avoid any loss of time while they can get water, that they run continuously through the season, cleaning up only once a year.

The dirt is soft, and 1,200 inches of water bring down as much as 3,000 can carry off, so only 1,200 are thrown through pipes, the remaining 1,800 inches being allowed to run down over the bank. There are three sets of pipes, three or four in each set. The pressure is 100 feet. Twelve men take charge of the pipes by night, and as many more by day; and 26 men are employed in shovelling bed rock and pay dirt, moving boulders out of the way, and so forth.

The day hands work 10 hours and the night hands 12 hours, and the pay for each is $3 50 per day. At night torches are made in iron baskets resting upon iron posts about five feet from the ground. In these baskets pine wood is burned, giving a very good light. Fires are also built on the ground so that the men can warm themselves.

The claim has outlet through two tunnels. The Northampton tunnel is 2,000 feet long, has a sluice six feet wide, and cost $160,000. Ten years were spent in cutting 500 feet, so hard was the rock. The Warren Hill tunnel is 2,000 feet long and 5 feet wide, and cost $15,000. The grade of both tunnels is 4 inches in 16 feet. The Northampton tunnel receives the dirt from two surface sluices, and usually carries 2,000 inches of water; the Warren Hill receives one sluice and carries 1,000 inches. The ground and the outlet do not permit the use of a steeper grade; and, as no small sluice could wash on that grade, it was necessary for the owners of small claims to sell out and let them be consolidated in one large claim. Another tunnel is being cut, to be 3,000 feet long, to drain another part of the claim.

Under-currents are not used here. Width is considered particularly desirable in sluices. The paving in the sluices consists of boulders as large as a man can lift, and they are worn out in a season. The water is shut off for an hour at noon every day, and men examine the whole length of the sluices, to see that the paving is all right and to repair any breaks.

About a ton of quicksilver is put into the sluices in a season, and one quarter of it is lost. The mercury, instead of being thrown directly into the sluice, is scattered on the surface of the bank which is to be washed down. It is put into a can made of Russian sheet-iron, large enough to hold 40 pounds, and the cap or nozzle of the can is perforated with holes an eighth or a quarter of an inch in diameter, through which the metal is sprinkled.

The ditch which supplies water for the claim is owned by the same proprietors, cost $100,000, but could now be constructed for $50,000. The length is 13 miles.

The preservation of the flumes against the snow is expensive. Whenever a snow-storm comes on men are sent to shovel the snow off, lest the weight should break down the flume; and then the snow must be shovelled away from the flume on the hillsides above, for the snow bank moves slowly down hill with tremendous pressure, which no flume could resist. The trees on the hillsides show this influence, for they are all bent down hill, and many are broken down every winter. It is necessary to cover the iron pipes with strong timber, or they would be crushed flat by the weight of the snow. The pipe used in this claim cost $2,000.

The channel is 500 feet wide; the grade, 50 feet to a mile; the rim-rock, 100 feet high on the east and 20 on the west, on an average. The deposit of gravel is 100 feet deep. It is white near the top; red, blue, and black at the bottom. There are many boulders of quartz quite black. In the upper strata the pebbles are seldom larger than a goose egg; in the lower there are many boulders from 6 to 20 inches in diameter. At the bottom is a layer two feet thick of hard cement, which is crushed in a five-stamp cement mill belonging to the same proprietors.

In 1866 Conly and Gowell washed off a strip of ground 1,100 feet long, 300 feet wide, and 80 feet deep, equivalent to 435,000 tons of 40 cubic feet each. The gross yield was $32,000 and the net $12,000. If we multiply the 1,100, the 300, and the 80 together, we find that 26,400,000 cubic feet, or 660,000 tons of 40 cubic feet each, were washed away; and if we divide the 660,000 tons by the $32,000 we find that 20 tons went to $1, or that the yield of the gravel per ton was five cents. This amount is so small that it suggests the probability of some error. It appears that the expense of washing was but three cents and a third per ton. No other place in the State can wash dirt so cheap.

The number of days spent in washing this area was about 100, and the average amount of water used 2,000 inches. An inch is 100 tons of water in 24 hours; and 2,000 inches supplied in 100 days 20,000,000 tons of water to move 660,000 tons of gravel, or 30 tons of water to 1 ton of gravel.

The claim of Conly & Gowell is large enough to last for 20 years longer.

Gard & Orr have a very large claim alongside of Conly & Gowell, use 2,000 inches of water, and employ 50 men; and their ground will last 20 years.

It is said that across both of these claims runs a perpendicular dike of lava or trap, rising out of the bed-rock and passing through the gravel entirely across the channel. This dike has never been pierced through, and its size is unknown. A similar dike, according to rumor, was found at Brown's diggings, 15 miles northwest of La Porte.

The two claims mentioned are the only ones of any note worked at La Porte. Ten years ago more than 50 companies were in profitable operation there.

The yield of La Porte and the placers which sold their dust there, in 1857, was $4,000,000 annually; now it is $1,000,000.

SECRET DIGGINGS.—Two miles south of La Porte is Secret Diggings, on the same channel and with similar gravel. The chief claim there is that of Kingdom & Co., who have about a dozen old claims. They employ 50 men and use 2,500 inches of water. The tunnel through which they wash cost $100,000, and is 1,500 feet long. In 1866 they took out $130,000 and divided $94,000, and that was the best yield the place ever had. This year the company have done as much work, but have not divided a dollar. The pipe used by Kingdom & Co. cost them $15,000. The claim is 80 feet deep, and will last many years.

Poverty Hill, a mile and a half below Secret Diggings, on the same old channel, has been worked on a small scale for 10 years, but the place is now to be supplied with water, and will probably become important. There is gravel enough there to last for 50 years.

PORT WINE.—At Port Wine the old channel is worked by drifting, and the principal claims are those of the Eagle, Union, Montecristo, Indian Queen, Erie, Sailor, Manzanita, Bunker Hill, and Pioneer companies.

The Eagle claim employs about a dozen men, all shareholders, and used to pay very largely.

The Indian Queen employs 15 men and has a tunnel 2,000 feet long.

The Union employs 40 men, all shareholders, and the tunnel is to be 3,000 feet long when finished.

The Montecristo employs 40 men, all shareholders. The dirt is hoisted through an incline by an engine, and water for washing is pumped up.

The Erie employs 10 or 12 men.

The Sailor has four or five men at work.

Nothing is done in the Manzanita claim.

The Bunker Hill employs eight men.

The Pioneer has four men.

LITTLE GRASS VALLEY.—The first place north of La Porte where there is any mining, on the same channel, is Little Grass Valley, three miles distant on the north side of the same ridge, between Rabbit creek and south fork of Feather river. The claims there have been worked on a small scale for ten years, but the ground is not rich, and the cutting of tunnels is very expensive. Most of the claims are worked by drifting. It is probable that Little Grass Valley will become a prominent mining town in time. Most of the gravel is covered by a bed of lava 300 feet deep.

Gibsonville, seven miles from La Porte, used to be an important hydraulic camp, but now the claims are worked by drifting, and the yield has fallen off very much.

Spanish Ranch is 25 miles from La Porte, on the ridge between the South Feather and the Middle Feather rivers. The gravel is 100 feet deep, and the claims are worked by piping.

North of Little Grass Valley is Union Valley, where there are two piping claims, with banks 40 feet deep. Washing has been in progress four years, but there are portions of the bank that do not pay well, and, as water is not to be had most of the year, the companies will work by drifting next year, and see whether a better result can be obtained in that way.

Twelve miles west of Saw Pit Flat is Hungarian Hill, where there are three piping and two drifting claims. The tunnels run 400 feet in the bed-rock, to drain the pay to the bottom. Twenty-five men are employed, and the average pay is about $8 to the man per day.

Badger Hill is three miles west of Hungarian Hill, and has four piping and five drifting companies; the yield is about $5 per day to the man.

Four miles northwestward from Badger Hill is Eagle Gulch, where six companies, with six men in each, are drifting, and all in pay. It is supposed that most of the claims will be worked out within two years.

Forty miles north of Quincy are the Grizzly Creek diggings, where 40 men are employed in piping. The claims are 50 feet deep, and the gravel is all quartz. The width of the channel has not been ascertained.

Saw Pit Flat.—Saw Pit Flat is on a ridge running down from Pilot Peak. The claims are all worked by drifting, and the place has no ditch, so washing is only possible from April to June, while the snow is melting. The extraction of gold was commenced here about six years ago, and there has been a steady increase in the production, with a probability that it will continue for some years. The pay dirt is reached through tunnels that cost at least $20,000 and three years' time to complete them.

The New York Company has been taking out gravel about 15 months, and have obtained $30,000 from it. There are 12 men at work, all shareholders.

The Eagle Company have been in pay four years, and have taken out $26,000. Eight or nine men are employed.

The Union claim has 12 men, and has been yielding pay four years.

Those are the only companies that have taken out pay.

The Buckeye Company have reached pay, but have not taken any out as yet.

Several tunnels are being cut at Washington Hill, a mile distant, on the other side of the ridge. Two companies, the American and the Washington, are in pay.

The Eureka mine, in American valley, is 1,800 feet long, on a vein running northeast and southwest, dipping northeast at an angle of 45°, and varying in width from 5 to 25 feet. The main pay chimney is 250 feet long, horizontally, and it dips southwest at an angle of 52°; but at a depth of 300 feet it seems to bend to the northeast. There are many varieties of quartz—some white, some blue, some rose-colored, and some dark brown. All the rock from the pay chimney is worked, and it has yielded from $10 to $30, except near the surface, where it was much richer. The present average at 300 feet from the surface is from $14 to $15. The foot wall is granite and the hanging wall hard slate. There are seven per cent. of sulphurets in the rock.

There are two mills, one of 12 and the other of 16 stamps, both driven by water derived from an artificial lake, and they are situated three-quarters of a mile from the mine. The ore is transported on a rail-track.

The gold is amalgamated in the mortar and on copper aprons, and the tailings are caught in a dam and saved for future working. There are not less than 10,000 tons collected.

Besides the stamp mills there are three Chile mills of cut stone, each wheel being nine feet in diameter and two in width, of granite. The bed-stones are five feet in diameter and a foot and a half thick. The wheels wear down so as to become useless in three years; and, in proportion to the power used, they do not grind half so much as stamps. About once in three months the bed-stone must be picked down, so that it will grind well.

The snow lies seven months in the year at the mills and on the track, and for five months the mill must lie idle for lack of rock. The mills might be moved to the mine itself, so as to be immediately at the mouth of a new tunnel that might be cut to strike the lode 400 feet below the present workings, at a length of 1,800 feet. The mills could then run the whole year, and might be driven by steam, or perhaps by the waters of Jamison creek.

Not less than $300,000 have been expended in improvements, all derived from the mine. The total yield is variously stated, by those who have had good opportunities for knowing, at from $1,400,000 to $1,600,000.

The mine was discovered by a party of adventurers who, in 1850, were on the search for Gold lake. The mountain side was covered with float quartz, and the prospecters took up claims 20 feet square. The Eureka Company, the first one incorporated for mining purposes in California, began operations in the spring of 1851, and since then the mine has paid continuously. The total dividends previous to 1865 were $250,000.

Besides the 1,800 feet on the Eureka lode there are 2,000 feet on other lodes.

In early days much of the mine was leased to Mexicans and others, who worked with arrastras and paid one-third of the gross yield. At one time 100 arrastras were running on the Eureka rock.

MAMMOTH.—Adjoining the Eureka, on the south, is the Mammoth, 1,200 feet long. The vein is very variable in size and quality in this claim, changing suddenly from a few inches to 20 feet in thickness, and then back again, and from very poor to very rich. The quartz is white and brittle, and is mixed with slate, so that much assorting is necessary. There is one chimney, 20 feet long horizontally, and 10 feet thick, nearly vertical, and it goes down with nearly uniform size. A depth of 200 feet has been reached, and drifts have been run 200 feet on the vein. The average yield has been about $12, and the total yield $400,000.

There is a 12-stamp mill driven by water. The gold is caught by amalgamation in the mortar and on copper aprons, and the blanket tailings are worked in Chile mills.

SEVENTY-SIX.—The Seventy-six Company are at work on a vein or branch vein, varying in thickness from four to 18 inches, and nearly horizontal for a distance of 150 feet from the surface, and at that distance it turns down. The lode is supposed to be the Eureka, or a branch of it. The assorted rock is packed on mules, at a cost of $6 per ton from the mine to three arrastras. Nothing is crushed unless it will yield $40 per ton. The average value of the rock is probably $18.

CRESCENT.—The Crescent mine, in Indian valley, 15 miles from Quincy, and 73 from Owenville, includes claims on three lodes as follows, viz:

Name.	Length.	Course.	Dip.
Crescent	3,000	East and west	North 35°.
Horseshoe	3,200	Northwest and southeast	Southwest 60°.
Pet	2,200	North 80° east	South 60°.

The walls are of feldspathic granite, according to Professor Ashburner, who made a report on it, and the quartz, so far as the work has advanced, is a reddish brown, with occasional masses of a bluish white color, enclosing undecomposed sulphurets of iron and of lead.

The Crescent vein varies in width from five to 50 feet, averages about 15, and appears to be the main lode of the cluster on which this mine is located. Six pay chimneys have been found, and two have been worked on this vein.

The eastern is 108 feet long, and the western 100 feet. Both have been stopped out to a depth of 120 feet, with an average width of five feet of pay, yielding from $13 to $18 per ton. The deepest workings on this vein are 140 feet from the surface, and drifts have been run 360 feet long.

The average width of the Horseshoe vein is about 14 feet, but the walls are not well defined. The quartz is harder than in the Crescent, and the pay has varied from $7 to $42, averaging from $15 to $18. There are two pay chimneys; the western 120 feet long at the surface, and 200 feet long, 200 feet below the surface, and the western 100 feet long at the first level, and 125 feet at the third. The pay chimneys dip a little to the east. A depth of 280 feet has been reached on this vein. The Pet vein has a pay chimney 50 feet long, and four feet thick, and the quartz yields $100 per ton.

The Union vein runs into the Horseshoe, and the intersection is rich, yielding $37 per ton.

The yield of the mine from November, 1862, till June 9, 1867, was $667,213 59, obtained from 40,000 tons, showing an average of $16 68 per ton.

Dividends have been paid to the amount of $100,000, and $150,000 have been spent in improvements.

The stock of ore in sight is estimated at 14,000 tons, to average $11 40 per ton, and 20,000 to average $7 or $8.

There is a 32-stamp mill driven by an engine with an 18-inch cylinder, with 40 inches of stroke.

The stamps weigh 810 pounds, make 60 blows per minute, and fall 10 inches.

The gold is amalgamated in the mortar, and on copper-plate, and the blanket sands are ground in a Wheeler and Randall pan. The blankets catch one-seventh of all the quartz crushed, and the blanket sands yield one-twelfth of all the gold saved.

There is a hoisting engine, which is supplied with steam from the mill boiler.

A 24-stamp mill was built in 1863, but was sold to another company. The present was erected in 1865. Thirty-two men are employed, eight at the mill, and 24 at the mine. There are 14 underground miners, who get $3 per day, and board themselves; five underground carmen, who get $2 75 without board, or $50 per month with board; two rock breakers, and four feeders, $2 75 per day; one amalgamator, $2 75, and another, (a boy,) $2 25 per day; one engineer, $100 per month; another, $4 12 per day; another $3 30 per day, without board; and a fourth, $45 per month, with board.

WHITNEY.—The Whitney mine is on the Crescent lode, one mile southeast of the Crescent mine. The course there is west 15° north, and the dip about 80° south.

The foot wall is granite, and the hanging wall slate. The vein varies in width from 15 to 30 feet, and the average is 20 feet. The walls are smooth, and well defined from the surface, and the quartz on the walls is in places polished smooth.

The quartz is soft, is taken out without blasting, and all in the pay chimneys is crushed. It is extracted through a tunnel 100 feet long, and the extraction and transportation to the mill do not cost more than 75 cents per ton. The average yield is $12 per ton, and the total yield has been $68,000. There is a 24-stamp mill, which began work in December, 1866.

The gold is caught by amalgamation in the mortar and on the copper aprons, and the blanket sands are ground in a Wheeler and Randall pan.

GOLDEN GATE.—The Golden Gate mine at Round valley is on a vein four feet wide, running northeast and southwest, and cutting across the slates. A depth of 60 feet has been reached, and drifts have been run 70 feet in pay all the way. The average yield has been $22. There is an eight-stamp mill, driven by water. It began to run about the 1st of June of this year, before which time the quartz was worked in a custom mill.

DIXIE AND BULLFROG.—In Dixie cañon there are three custom mills, one of eight, one of six, and one of four stamps. All were erected to work claims which did not pay.

The Bullfrog mine at Rush creek is on a vein eight feet wide, running east and west. A depth of 130 feet has been reached, and drifts have been run 200 feet on the lode. The quartz yields $8 gross and $3 net. The mill has 12 stamps, goes by steam, and was built in 1865.

LIGHT AND CALLAHAN.—Light's mine, in Genesee valley, is on a vein two feet and a half wide, running east and west. The quartz is taken out of an open cut, 40 feet long and 30 feet deep, and the yield is $18 per ton. The mill has eight stamps, goes by water, and was built this year.

Callahan's mine, in Indian valley, has been opened to a depth of 100 feet, and to the same length, in pay all the way. Some of the rock crushed at Custom mills has yielded $12 50.

PREMIUM AND SPARKS.—The Premium mine has been opened by a shaft 125 feet deep, and by a drift of 50 feet. Some rich specimens have been obtained, and rock crushed at custom mills yielded $19.

The Sparks and Halsted mine at Granite Basin is on a vein eight feet wide. A 12-stamp steam mill is going up.

INDIAN VALLEY.—The Indian Valley mine is on a vein six feet wide, running east and west, and dipping to the south. A depth of 220 feet has been reached, and drifts have been run 200 feet on the vein. The rock is hard, and yields $18 per ton. There are two mills; one of 16 stamps, driven by water, and another of 12 stamps, driven by steam. The mills have been running since 1864, and the general yield per week has been $2,200.

GREENVILLE.—At Greenville the Union and McClellan Company are working a vein two feet and a half wide. They have gone down 190 feet, and run 160 on the vein. There are two pay chimneys, each about 30 feet long, dipping to the west. The company has two mills, each of eight stamps, but the supply of quartz is not sufficient to keep them running more than half the time. The company are building a mill of 16 stamps to work a claim on the Caledonian lode.

SECTION XIV.

ALPINE COUNTY.

This county, situate on the summit and eastern slope of the Sierra Nevada, and on spurs making out from the latter, is, as its name denotes, rugged, mountainous, and truly Alpine in its external features and situation. The Sierra, along its western border, rises to an elevation of nearly 10,000 feet. Silver mountain, a short range running north and south across its centre, is nearly as elevated. Even the lowest valleys have an altitude of scarcely less than 5,000 feet, many of them lying much higher. As a consequence the climate in the winter is rigorous, the snow falling early and lying on the mountains, where it falls to a great depth, until midsummer. Even in the lowest and most sheltered valleys it usually falls to the depth of several inches, lying sometimes for two or three months in the winter. The weather during the summer, without being excessively hot, is warm; that of the later spring and the fall months is delightful. Showers are more frequent here during the dry season than west of the Sierra, or in the State of Nevada, lying to the east. Owing to this, vegetation keeps green until a later period in the summer. The grass, of which there is a good deal, affords by its succulence excellent pasturage. There is but little agricultural land in the county, though a number of small valleys produce fine crops of hay, grain, and vegetables. Almost the entire region is covered with heavy forests of pine and fir, from which immense quantities of lumber and firewood are made every season. Five million feet of saw-logs and 6,000 cords of wood are floated down the Carson river annually for the use of the Comstock mines. On the Sierra Nevada, within the limits of this county, are a number of small lakes of the greatest purity and coldness, the waters of which are supplied by the melting snows. These lakes are the sources of several considerable streams, the Carson river, running north into Nevada, and the Stanislaus and Mokelumne, west into California, heading here. Besides these there are many creeks, tributaries to the Carson, which, with the latter, supply a very extensive water power and means of irrigation. Alpine contains a number of small towns, of which Kongsburg, the county seat, Monitor, and Markleeville are the principal. The population of the county is about 2,000. There are three quartz mills in this county, carrying 26 stamps, and costing in the aggregate about $100,000; 13 saw-mills, carrying 19 saws, and having a capacity to cut 112,000 feet daily; aggregate cost about $100,000. Considering its small population and rugged surface, this county is well supplied with good wagon roads, having one leading across the mountains connecting the principal towns with the Big Tree road running to Stockton, and several others, built at heavy expense; one of which runs to Carson valley, there uniting with the road to Virginia City, and also with that leading over the Sierra to Sacramento *via* Placerville. The inhabitants of Alpine have displayed much enterprise in road building, having, for their means, expended more money and labor on these improvements than any other community in the State. The first silver-bearing lodes were discovered in this region in 1861, since which time 14 different districts have been organized within the limits of the county, in some of which a large number of ledges have been located and much exploratory work done, while in others the reverse is the case. The metalliferous veins here are usually of good size, many of them very large, being from 20 to 80 feet thick on the surface, and occasionally much larger. The most of them, however, range from 6 to 10 feet in thickness, running in a generally north and south direction, with a trend to the southeast in conformity with the longitudinal axis of the Sierra. The vein-stone consists of quartz and carbonate of lime. The country rock is composed of porphyry, granite, trap, and slate. None of the lodes carry rich ores on or near the surface, necessitating deep development before any considerable bodies of a sufficiently high grade for milling can be obtained; a circumstance that has tended greatly to retard the advancement of the mining interest in this county, capitalists overlooking the masterly character of the lodes and the unrivalled advantages for the cheap reduction of the ores enjoyed here, and investing in mines much less favorably situated simply because they carried small quantities of rich ore in their upper portions. Left thus without aid, the miners of this county have not been able, with their limited means, to develop more than a few of their claims to a productive point, although a number of years have elapsed since operations were commenced here. Another evil has been the want of concentration of labor, their efforts having been spent in attempts at operating too great a number of lodes, thereby defeating the thorough development of any. But besides these superficial and ineffectual labors, several works looking to deep exploration have been planned, some of which, though involving heavy expenditures of labor and money, have been carried almost to completion. The aggregate amount of tunnelling done in the county is very large, many of these works being from 500 to 1,000 feet long. Owing to the precipitous character of the mountains in which most of the lodes are situated, the method of their exploration by tunnels has been generally adopted. Their declivities in many places are so steep that a depth beneath the croppings is attained equal to the length of the tunnel when it reaches the ledge. This is frequently the case in the Silver Mountain district, where a number of tunnels, some of them well advanced, are expected to tap the lodes for which they are being driven at depths varying from 1,000 to 1,200 feet, which will also be about their horizontal length. The mountains near Königsburg, in which a great many lodes are situated, vary in height from 2,000 to 3,000 feet. The main ranges a little further back are much higher. The ores of this county are very diversified, carrying, besides the precious metals, copper, lead, antimony, arsenic, &c., a combination that renders them refractory and costly of reduction: roasting and careful amalgamation, and, in some cases, smelting, are processes necessary to success. The croppings generally show by assay free gold, together with gold and silver in combination with iron pyrites, which latter gives place to copper as depth is attained. Some veins contain so large a percentage of this metal as to justly bring their contents under the class of argentiferous copper ores, which can be successfully treated only by smelting, for which there exist here the greatest facilities, wood being nearly everywhere abundant. Much of this ore, it is believed, contains enough of copper to defray the entire cost of mining and reduction. After much experimenting with a view to determining the best mode for treating the ores of this county, this end is thought to have been recently attained, and the product of bullion, though still small, is steady and constantly increasing, amounting at the present to between $7,000 and $8,000 monthly. From the energy displayed in efforts to overcome the rebellious elements present in these ores, and to further the development of the mines, there is reason for believing that this amount will be increased the coming year. The most efficient plan, and that at present adopted, for the management of these ores is, after kiln-drying and crushing, to roast and then amalgamate them by the Freiburg barrel process. The following prices paid by mill companies for ore indicates its value for purposes of reduction: Kustel & Uznay contracted with the Morning Star Company last year to pay them $17 50 for 10,000 tons of ore from their mine at Mogul, the purchasers extracting the ore at their own cost. The Washington Mill Company have contracted to pay $100 per ton for 100 tons of first-class ore to be delivered from the IXL mine, in the Silver Mountain district. The ores from the Tarshish mine, near the town of Monitor, are found to yield, with careful treatment, over $200 per ton; and it is thought there are other lodes here the ores from which, by a careful selection, will turn out nearly as well. The Tarshish lode is of large dimensions, the tunnel now in course of excavation having penetrated it 90 feet without reaching the back wall. The ores, a large portion of which are of high grade, lie in bunches or chimneys, and, if developed to its fullest capacity, there is no doubt but this mine could be made to yield ore enough to keep a large-sized mill in steady supply. There is at present much activity in several mining districts in this county, work having been resumed upon a number of claims for some time neglected, and being pushed with increased energy upon others; and there can be no question but the business of mining will make greater progress in future than it has heretofore done in this region. In the matter of wood and water there is not a county in the State better situated than Alpine; the facilities for the cheap exploitation of the mineral lodes are great; while freights, owing to its proximity to the principal points of supply, are much lower than in almost any other mining district east of the Sierra. The water power in this county is ample for the propulsion of several thousand stamps, while timber, both for fuel and lumber, is present in inexhaustible supply.

SECTION IV.

LASSEN COUNTY.

This county, erected from Plumas in 1864, lies upon and to the east of the Sierra Nevada mountains. It is named after Peter Lassen, one of the pioneer settlers of northeastern California, who was killed by the Indians in 1859 while exploring the northwestern portions of Nevada for silver mines, then supposed to exist in that region. The county contains but a small population—only about 1,500. It was organized because of the isolated situation of the inhabitants, separated by the Sierra from the county seat of Plumas. The votes polled in 1864 numbered 554; the value of real and personal property now in the county is estimated at about $800,000—a large amount, considering the limited number of people it contains. The western portion of the county is covered by the Sierra Nevada; the remainder consists of rugged and barren hills, sage plains, and alkali flats, with a small extent of rich valley lands. The Sierra is heavily timbered quite to its base. Heading in these mountains are a number of fine streams, of which Susan river, Willow, and Elision creeks are the principal. They afford extensive propulsive power and water for irrigation, to both which uses they are largely applied. These streams run into Honey lake, a shallow body of water lying on the eastern border of the county, and which, though it covered a large area some years since, is now nearly dried up. It has no outlet, and its water, or what little is left, is slightly alkaline to the taste. Along its shores are one or two spots of tulé marsh; the rest is high and barren. Nearly all the valuable land in the county lies in Honey Lake valley, a fertile and well-watered tract of some 50,000 or 60,000 acres, lying between the base of the Sierra and the lake. It is all taken up and enclosed, the greater part being under cultivation or appropriated to hay-making and pasturage. Much stock is kept here, besides large quantities of grain of every description raised annually. Wheat, barley, rye, and corn grow luxuriantly, and, with irrigation, yield largely. Vegetables thrive and most kinds of fruits mature without difficulty. Cattle here require neither stabling nor fodder during the winter; even work animals keep in good condition feeding on the rich succulent grasses of the valley. Owing to the abundance of good timber close at hand, the most of the fencing is made of posts and boards, and the houses of the settlers for the same reason are large and substantial. Good lumber can be obtained at the mills here at about $20 per thousand. In Long valley, a small portion of which is in this county, there is also a little good agricultural and pasture land. Honey Lake valley received its name from the quantity of honey dew, a sweet and viscid substance precipitated from the atmosphere during the spring and early summer months. The climate in this valley is extremely mild and agreeable; the heat of the summer is moderate, and but little snow falls during the winter. There is a group of hot springs near the head of the valley, some of which are very large, and one so deep that its bottom has never been reached by sounding. It boils with such fury that the water leaps several feet high. The others are not so hot, though all are impregnated with iron, alum, soda, or other mineral substances. The only town of any size in the county is Susanville, the county seat, in which there is a flourishing school, a church, and many large and well-built houses. The county contains seven sawmills, running 11 saws and capable of cutting 50,000 feet of lumber daily. They are propelled by water, and cost in the aggregate over $50,000. There are also two flour mills, having three run of stone and capacity for grinding 90 barrels of flour daily. They are driven by water and cost about $12,000. There are 20 miles of water ditches, built at a cost of $25,000, and several wagon roads within the limits of the county, leading over the Sierra into California. Lassen contains no quartz mills, though there are numerous ore-bearing veins of both the useful and the precious metals in the county. The most of these are found in the mountains adjacent to and west of Honey Lake valley, where placer diggings and auriferous quartz were discovered in 1862, at which time the former were quite extensively worked and paid fair wages. Some of these quartz veins also carry silver, and various working tests made on a small scale tend to show that these veins may yet be profitably worked on a large scale, as the ores can be cheaply reduced, owing to an abundance of wood and water in the vicinity of the mines.

SECTION XVI.

STANISLAUS, FRESNO, TULARE, MERCEDE, AND SAN JOAQUIN COUNTIES.

Stanislaus has a sectional area of 1,228 square miles, consisting chiefly of agricultural lands. Population in 1860, 2,245; estimated in 1866, 3,460; assessed valuation of real and personal property in 1866, $1,026,216.*

The principal towns are Knight's Ferry, the county seat, on the Stanislaus river, where it debouches on the main San Joaquin valley, and Lagrange. The business of the county is mostly centred in these towns. At Knight's Ferry there are valuable quarries of sandstone. The freighting business of this county amounts to 4,444½ tons.†

Fresno.—This county, to the south of Mariposa and Merced, in sectional area is one of the largest counties in the State, reaching from the Coast range to the eastern boundaries of the State, containing 9,240 square miles; of this about 444,800 acres are agricultural lands of superior quality. The population of Fresno in 1860 was 4,605; estimated in 1866, 1,680; assessed valuation, $811,716, in 1865; in 1866, $826,000.

The copper mines in the Hamilton district, near the Chowchilla river, are no doubt extensive. The lode is clearly defined for ten miles with croppings of great richness. The shipments of copper from this district will, it is believed, in time rival that from Copperopolis. At present the shipments are light, as the cost of transportation to San Francisco is $80 per ton, which makes copper mining in this county unprofitable at present. With facilities for transportation by way of Knight's Ferry, and thence by the proposed Stockton and Copperopolis railroad to Stockton, copper ores will eventually bear shipment.

The down freights from this county, principally from the Chowchilla mines, were, in 1865, 1,800 tons. Two other mines shipped by way of the San Joaquin 120 tons per month, but there is little doing now, owing to the depreciation in the business of copper mining. The up freights to Fort Miller are 875 tons per annum; the total freights to and from this county probably amount to 2,675 tons.

Tulare.—The county of Tulare, to the south of Fresno, contained in 1860 a population of 4,638; estimated in 1866, 4,890; an assessed valuation in 1865 of $1,306,380; in 1866, $1,299,379; agricultural products for 1865, $616,890; a sectional area of 7,181 square miles, of which about 200,604 acres are good agricultural lands, the rest mountain and tule lands. There are gold veins in this county which are now being developed, and which will increase the present freights to a large amount. The freights for 1865 were as follows: Up freights, 2,750 tons; down freights, 409 tons; total, 3,159 tons.

There is no outlet for the northern portion.

Mercede.—West of Mariposa county lies Mercede, mostly an agricultural county, the central and western portion of which has, to some extent, an outlet on the San Joaquin river. Sectional area, 1,384 square miles; population in 1860, 1,141; estimated in 1866, 1,980; real and personal property, $816,318;

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* Pacific Coast Directory.

† W. C. Watson's report.

principal shipping points for up freight, Merced Falls and Snellingsville, six miles below. Here, as well as at Knight's Ferry and Lagrange, on the Tuolumne, is a large amount of water power, capable of being used at a little expense, and which will at no distant day be turned to good account. Freighting business of this county, 562 tons.*

San Joaquin.—The sectional area of this county is 1,452 square miles, (929,280 acres,) about one-third of which is agricultural, the rest foot-hills and tule lands.† The agricultural products in 1864 amounted to $4,445,058; assessed valuation in 1865, $14,986,615; population in 1860, 8,434; estimated population in 1866, 17,140; real and personal property in 1866, $5,275,016.‡

SECTION XVII.

INYO COUNTY.

This county was erected in 1866. The territory was taken from Tulare and Mono counties, and lies on the border of the Great Mohave Desert, east of the Sierra Nevada range of mountains. With the exception of a considerable strip of arable land along Owen's river, and some fertile spots at the entrance of the ravines that make up into the Sierra, the country is arid and barren. Except the portion lying on the Sierra, and some scattered groves of piñon on the range east of Owen's valley, the country is also destitute of timber. The only water, save a few small springs, consists of that flowing through Owen's river and the streams that, falling from the mountains to the west, feed it or run into the lake that receives its waters. Owen's valley, over a hundred miles long in its whole extent, and from 10 to 15 wide, lies along the western border of the county, having the Sierra Nevada mountains on the west and the Monaché chain on the east. These mountains cover three-fourths of its area and give to the county a rugged and diversified aspect. The tillable land along the river is not more than a mile and a half wide, but as it reaches the entire length of the valley it amounts in the aggregate to 60,000 or 70,000 acres, the most of it very fertile and capable, with irrigation, of growing every kind of fruit, grain, and vegetables in the greatest luxuriance. This strip of land is covered in its natural state with a coarse, wiry grass, not fit for making first quality of hay, though the cultivated grasses could easily be domesticated here. They are found to grow readily when planted after the manner of grain. The rest of the valley, like the surrounding country, is nothing but a sage barren, producing, besides the artemesia, only a little bunch grass, with a few shrubs almost as worthless as the sage itself. The river, running through the middle of the valley, is deep, narrow, and crooked, and has a swift current, which, with its generally marshy banks, renders fording difficult. In the summer, during the melting of the snow on the mountains, it overflows its banks in many places, particularly the tule lands, of which there are good deal along its borders. The mountain streams, after flowing out into the valley a short distance, spread out over the surface, irrigating it and producing large patches of clover. These spots were the favorite abodes of the Indians, who planted a variety of roots, grasses, and other vegetable comestibles, which they irrigated, conveying the water through small ditches and channels formed with mud, often quite a distance. In the possession of the whites they will soon be converted into luxuriant gardens, orchards, and grain fields. Along Owen's valley there are already a large number of fine, well stocked, and cultivated farms, many thousand bushels of grain having been raised there, besides butter and cheese made for several years past. Five hundred thousand pounds of grain were raised last year, and still larger quantities this. These farms with proper culture produce as abundantly as the richest valley lands elsewhere in the State, the yield of wheat and barley being often at the rate of 40 and 50 bushels to the acre. Cattle keep fat here running in the pastures the year round, no stabling or fodder being required. The population of the county, for several years greatly diminished on account of Indian difficulties, is now about 2,000, having increased largely within the past six or eight months on account of the very flattering prospects of the mines. The assessable property is estimated at three-quarters of a million dollars, and there is no doubt but both the population and wealth of the county will be largely augmented hereafter. A number of towns have been laid out, some in the vicinity of the mines and others in Owen's valley, but none of them have yet attained any great size. Bend City, San Carlos, and Independence are in the valley, Kearsarge City being 10 miles west of Independence and near the famous mines of that name. Lake City, laid out in 1862, is at the south end of Owen's Big Lake. It contained quite a population at one time, but is now nearly deserted. Bend City and San Carlos also contain fewer inhabitants than they did several years since. The late accessions to the population are mostly in the mining districts. Independence, the county seat, is a growing and thrifty town, with a school and other evidences of progress. Fort Independence, the military post near by, adds much to the business of the place, there being at all times several companies of troops stationed here. The fort is a well-built, comfortable structure, with well-improved grounds and outbuildings about it. Mount Whitney, the highest peak in the Sierra Nevada, and claimed to be the most elevated land in the United States, is over 15,000 feet high, and lies within the limits of Inyo county. There are several other peaks in the neighborhood ranging from 10,000 to 14,000 in height. Snow lies on some of these peaks all summer. The whole range is covered nearly to its base during the winter season, though but little snow lies in the valley during the coldest weather. The summers here are hot, the thermometer standing much of the time at 100° in the shade, but throughout the rest of the year the weather is mild and pleasant. But little rain or snow falls, except on the mountains, rendering the county extremely arid and making irrigation necessary for the growth of the crops. For introducing water upon the land many small ditches have been dug, also some of larger dimensions: one, the San Carlos, taking water from Owen's river, is 15 miles long and cost $30,000. There are two saw-mills and nine quartz mills in the county. The former are driven by water, are capable of cutting about 10,000 feet of lumber daily, and cost $7,000. Seven of the quartz mills are driven by steam and two by water power. The whole carry about 100 stamps and cost nearly $400,000. Some of these mills were erected several years ago, at a time when the proper mode of treating the ores in this region were but ill understood, and as a consequence proved failures. Most of them gave up after a few ineffectual efforts, and have remained idle ever since. Those put up more recently are supplied with the necessary appliances for the successful management of the ores, and have mostly been operated with satisfactory results. Besides these mills there are about 20 arrastras running in the county. One flour mill has lately been built in the valley, and the grain crop being large, will no doubt do a prosperous business. This county is reached from California by several good roads; one from Los Angeles, which entering Owen's valley from the south, is unimpeded by snow at all seasons. With the exception of a few miles of desert it is a good road, nearly level, and the one over which most of the freight has heretofore been taken in. Another coming in from the State of Nevada enters this valley at its northern extremity, and, though most employed for transporting goods intended for the northern parts of the county, is not passable for teams on account of snow during the winter. The other road, *via* Walker's Pass, enters the valley centrally, and though never seriously obstructed by snow, is not much used by teams on account of its steepness in places and the great distance goods have to be hauled on this route. Eight or 10 different mining districts have first and last been erected within the limits of this county, in all of which there are many metalliferous lodes of value, though working tests, owing to the extremely rebellious character of the ores, have not as yet proved wholly satisfactory. The ores here consist mostly of argentiferous galena, and can be successfully reduced only by smelting, a method now generally adopted in most of the districts. The mines are situated in the two main ranges of mountains running in a northerly and southerly course across the county, the Sierra on the west, and the Monachi or Coso range on the east. In the latter is located the Lone Pine district, abounding with veins varying in thickness from one to 40 feet, nearly all carrying a good grade of ore, much of it yielding, by the rude smelting process now employed, from $50 to $100 per ton. At present only the richest ores are worked and a large percentage of the metal is lost, calling for more economical and effectual modes of treatment. That these will soon be supplied seems probable, as the attention of scientific miners and capitalists is now being directed to that quarter. The ores here are to be had in great quantity, and as population is flowing into the district, supplying an abundance of available labor, there is no doubt but the product of bullion will be large within a few years. In the other districts, except Kearsarge, and one or two others, there is but little work being done, though, as stated, they all contain valuable gold, silver, and copper-bearing lodes. The Kearsarge district is situate on the eastern declivity of the Sierra, here very steep, and at a point about 12 miles west from Fort Independence. The lodes here, which are from two to five feet thick, carry a fair percentage of silver, which is their predominating metal. The lode of the Kearsarge Company, the most thoroughly explored, contains ore of good average grade. This company, after erecting a 10-stamp mill, met with difficulty in saving the metal known to exist in their ore; hence they have been obliged to delay running their mill until by varied experimenting they have determined the best method for its treatment. It is confidently expected that liberal returns will be secured, as there can be no question as to the richness of the ore. A tunnel 100 feet in length has been run to the ledge of this company, opening it to a depth of 180 feet beneath the croppings, the side of the mountain here approaching so near the perpendicular. Other companies are at work near the Kearsarge opening their claims, all of which afford encouraging prospects, and as there are here wood and water in abundance this may in time become a prosperous and productive district. In addition to gold and silver, this county contains many other metals and minerals, such as iron, copper, sulphur, and salt, the latter existing about a small lake in Owen's valley, in such quantities that it can always be procured there at a merely nominal cost.

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* Watson's report. † W. C. Watson. ‡ Pacific Coast Directory.

SECTION XVIII.

MONO COUNTY.

This county, like Lassen and Alpine, lies upon and to the east of the Sierra Nevada. It is very elevated, and constitutes the water-shed between the basin of Carson and of Owen's rivers, both of which streams, though running in opposite directions, have their sources in this county. As a consequence, the climate is rigorous, snow falling in the winter to a great depth, even in the valleys, and ice sometimes forming at night in the summer. There is a narrow belt of alluvial land along several of the creeks falling from the Sierra into Mono lake, and a few thousand acres at the Big Meadows on Walker river, with some small patches elsewhere in the county; yet the amount of arable land it contains is small.

Some farming is done at each of these places. The crops planted are mostly potatoes and other vegetables, which, with careful culture and irrigation, generally mature and yield well. A large amount of hay is cut every year at the Big Meadows. Aurora and the most of the mining camps in the county get a good share of their supply there.

Mono contains about 1,000 inhabitants, scarcely as many as it did six or seven years ago, when the placer mines gave employment to a large number of men. These mines, discovered in 1857, were worked for four or five years thereafter with much profit to such as held the better class of claims, the daily earnings varying from $5 to $20 to the hand. The working seasons, however, were somewhat contracted, and the digging in many places deep, while the cost of living was high, whereby the net yearly savings were reduced to moderate rates. The mines lay in alluvium washed from the Sierra and lodged in a field of enormous granite boulders, their area finally proving to be of no great extent, which, after the summer of 1861, led to their gradual abandonment. A town named Monoville grew up at these diggings, which by the census of 1860 contained 900 inhabitants, the most of whom on the discovery of the silver lodes at Aurora, that year, removed to that place, to which also most of the buildings at Monoville were afterwards transferred. For several years after some placer mining was still carried on, but at present there is scarcely anything being done at these diggings. There are, however, near them a number of small quartz lodes containing free gold. Some of these were worked in 1860, by means of arrastras, driven by water, and for a time good results were obtained; but the pay streak in these lodes was very narrow, rendering it expensive to get out sufficient ore to keep the arrastras running, which led to a final cessation of work upon them. With more thorough development it is thought these veins could still be worked with remunerative results. There is water at hand for driving a considerable number of stamps. For supplying water to the placers a ditch 20 miles long was built in 1860, at an expense of $75,000, which work might still be made available as a power for driving machinery.

Mono lake, the principal body of water in this county, having been elsewhere described, it only remains here to speak of the numerous streams falling from the Sierra, some flowing into the lake, and others uniting in the Big Meadows and forming the east fork of Walker river. Many of them are large, and by their volume and fall create an immense water-power, a portion of which, as they run through the finest of timber lands, has been applied to the propulsion of machinery. Mono contains a great extent of pine and spruce forests, ranging along the Eastern slope and the foot-hills of the Sierra. Those in the vicinity of the Big Meadows are the most valuable. The trees here, though not extremely large, are straight and well formed. There are eight saw-mills in the county, having an average capacity to cut 5,000 feet of lumber daily. They are mostly driven by steam, and cost from $2,000 to $10,000 each, or an aggregate of $35,000. A large quantity of lumber is made here every year, which finds a market at Aurora and in the adjacent mining districts. There are three quartz mills in the county, two in the Bodie district driven by steam, and one at Hot Springs driven by water. The former carry, the one 16, and the other 12 stamps, and the latter four. The entire cost of these mills has been about $200,000.

The only town of any size in Mono is Bridgeport, the county seat. It is situate at the Big Meadows on the east fork of Walker river, and is surrounded with fine agricultural and hay lands, with a stretch of excellent timber a short distance back on the foot-hills of the Sierra. From Bridgeport to Aurora a good wagon road has been built, also an expensive road across the mountains to Stockton, California. The vote in this county numbers a little over 300; the value of real and personal property is estimated at $400,000. It contains a number of hot springs, one group, situate in the foot-hills on the road to Stockton, discharges a large volume of boiling water. Mono is not without valuable ore-bearing veins, both of gold and silver. Some of these are described in the chapter on Esmeralda county, Nevada, being situate in the Blind Spring and other districts lying partly in that State, and partly in California. In the Bodie district, 10 miles east of the county seat, are some gold and silver-bearing lodes, several of which are explored by means of tunnels, varying from 300 to 800 feet in length. There are also two quartz mills in this district, both of which, having, as is supposed, overcome, after many ineffectual and costly trials, the difficulties met with in working the ores here, are now in a fair way of achieving success. That there is some fair grade ore in these lodes has been clearly shown, the only trouble having been to hit upon a proper mode for their reduction. This having now been attained, and two well-appointed mills placed upon the ground, it may reasonably be expected that some bullion will be sent from this district the incoming year. Within the present year a new district named Castle Peak, lying a few miles southwest of Bridgeport, has been erected, a large and very rich gold-bearing lode having been found there. It lies immediately under and to the northeast of Castle Peak, one of the highest summits along this portion of the Sierra. Very rich float rock had been observed here, which led to the prospecting of the locality and, after some time spent, to the final discovery of the lode mentioned. Placer mining had for some years been carried on along the streams below, with success, the gold found having been released from this large vein and carried by the water of these creeks, and deposited along their banks. The most of this mining has been done by Chinamen, a company of whom are still at work, realizing wages that to these people are satisfactory. The exploration of this recently discovered lode is now being prosecuted, and it gives promise of proving a good vein. It is situated at the line of contact between two favorable formations for the production of metal, granite and slate. Gold predominates in value, though the lode is also well charged with sulphurets of silver, and from assays made it is calculated that the ore will yield by mill process, under the most inexpensive mode of treatment, from $40 to $60 per ton. The means essential to an economical reduction of ores prevail here, the mines being in the midst of stately forests, with two large creeks—Virginia and Green—but a couple of miles distant, affording sufficient power to carry several hundred stamps. A large number of claims in addition to the original location have been taken up on this ledge, and as some of the owners are possessed of energy and means, it is thought that operations will be initiated here the coming season. The erection of several mills has been determined upon, the work of exploration to go on meantime, and it is generally believed an active mining camp will spring up here next summer.

SECTION XIX.

MINING DITCHES.

Ditches occupy an important place in the mining of California. Indeed, it may be said that without them the mines of the State would be relatively insignificant. At least four-fifths of the gold is obtained with the assistance, direct or indirect, of ditch water. There are very few springs in the mining regions, the bed rock being usually slate with perpendicular cleavage, through which the water soaks down to the lowest levels. The permanent streams are found only at long intervals, and run in deep, steep, and narrow channels. Nature has furnished no adequate supply of water near the surface for towns or for quartz mills; so they, as well as the hydraulic pipes and sluices, must depend upon ditch water, which thus is an indispensable requisite to the production of four-fifths, perhaps nineteen-twentieths of the gold. It is fortunate that the mountain ridge east of the mining district rises high into the region of snow, where the moisture that falls from the atmosphere in winter is condensed and retained until summer and fall. But without the ditches this moisture would do little good to the miners, since there are few camps near springs or on the immediate banks of constant streams.

Expensive Construction.—The first experiments in ditching in 1850 were magnificently successful. The canals were short and small, and the water was either sold at a very high price, or was used in working out rich claims. It was not uncommon for several years for little ditches to repay the cost of construction in a couple of months. It was supposed that the right to the water of a good stream would be worth a fortune. The merchants in each town considered it their interest to encourage and assist the miners to bring in water, so as to increase the population, gold production, and trade. The country was full of enterprise and money, for which there was not much other use. Numerous ditch companies were formed to bring water from the elevated regions in the mountains, and many had invested too much to withdraw before any of them had learned the business before them by experience. The work was done when labor was very high; the price for common laborers being $8 per day, and lumber was $100 per thousand feet. Before the canals were finished, wages had fallen 50 per cent. or more, and the work done was worth in the market only half its cost. Besides, in 1851 and 1852 the common price for water was 50 cents or $1 an inch, and the ditch companies made their calculations upon charging those figures, but before the completion of the ditches the best claims in the ravines had been exhausted, and there was not enough rich ground left to pay high prices for all the water.

Bad Engineering.—The ditch companies did not find good hydraulic engineers. Many of the canals were constructed under the influence of carpenters who wanted to turn their skill in wood-work to account, and wherever it was possible they constructed wooden flumes, even in places peculiarly favorable for ditching, and where the latter would have cost less than fluming. The flume loses value every year, while the ditch, by getting more solid, gains. The flume must be rebuilt about once in six, eight, or at most ten years, and the ditch, never. The flume soon leaks, and the ditch after a time loses very little by leakage.

High Flumes.—But the mistake in constructing flumes resting on the ground was little compared with the loss suffered by constructing high flumes, which were wonderful specimens of engineering skill, and still more wonderful samples of bad investments. It was common to see flumes 100 and 200 feet high, and there is one now standing near Big Oak Flat, in Tuolumne county, 256 feet high. These high flumes are very costly, and are frequently blown down. The water could, in most cases, have been conveyed in iron pipe, which is much cheaper, and far more durable, and in many instances it could be and has been conveyed in ditches, constructed at small cost round the head of a ravine. As the yield of the mines decreased, the charge for water became onerous, and the miners formed combinations to compel a reduction of rates, and these strikes were accompanied sometimes by malicious injuries to ditches and flumes.

Unprofitable Investments.—The big ditches, almost without exception, proved unprofitable. Some of them have paid more than their cost, but not near so much as the same money would have paid at the current rates of interest. It is estimated by competent men that not less than $20,000,000 have been invested in the mining ditches of California, and that their present cash value is not more than $2,000,000. In many cases they broke the men who undertook them. Most of them have been sold by the sheriff, some of them several times over; breaking the first purchaser, as well as the builders. Bean's "History of Nevada County," speaking of the South Yuba ditch as a remarkable work, says: "While nearly all the canal enterprises of the country have passed from the control of the men who conceived and executed them, the South Yuba canal remains a triumph, as well of the engineering as of the financial ability of its managers, still remaining in possession of the fathers of the enterprise, and owned without an incumbrance or enemy, all the men who assisted in any degree in the construction of the works having long ago been paid to the uttermost farthing."

DECLINE IN VALUE.—There is a steady decline in the value of the ditches, as there is a steady decrease in the yield of the placer mines, which consume nine-tenths of the water. The Truckee ditch, which was completed in 1858, at a cost of $1,000,000, to supply the towns on the Blue lead, near the southern border of Sierra county, has gone to ruin. Forty miles of the new ditch, at Columbia, have been abandoned, and 11 miles of the Amador ditch are abandoned. Besides these costly main trunks of large canals there are hundreds of miles of branches, each large enough to carry 100 inches or more, that once supplied water to thousands of miners, who have now left their camp, and the ditches are dry and broken. The Mokelumne Hill Ditch Company is now constructing a branch ditch to Cat Camp; the Sears Union Ditch Company, in Sierra county, are constructing a branch to Poverty Hill and Scales's Diggings, and the proprietor of the South Fork canal, in Eldorado county, is talking of building a new ditch, to be 50 miles long, and to carry 5,000 inches of water; but it is probable that more miles will be abandoned during the next three or four years than will be built. The receipts of the Bear river and Auburn canal show a steady decline from $90,000 in 1863 to $40,000 in 1866. One of the best-informed ditch miners in Tuolumne says that the receipts of the ditches in that county decrease six per cent. every year on an average, while there is no correspondent decrease of expenditures. The decrease in the State generally is probably not less than 10 per cent.

THE SUPPLY OF WATER EXCEEDING THE DEMAND.—Many of the companies are seriously troubled by inability to sell all their water, and some have commenced to buy up mining ground to wash on their own account. It not unfrequently happens that miners finding their claims will not pay, after having run in debt to the water company, transfer their claims in payment, and the company, by hiring Chinamen, and requiring the ditch tenders to devote their spare hours to the labor of superintendence, and using water for which there is no sale, manage to make a good profit where the original claim owners could make none.

SMALL DITCHES.—Although the large ditches, as a class, are unprofitable, many of the small ones pay very well. The minor ditches are short, constructed on favorable ground, have no high flumes to be blown down by the wind, or to be broken by the snow, or swept away by avalanches, and not unfrequently they pick up water that escapes from a ditch higher up, so they avoid many of the most serious expenses of the larger ditches. They usually run dry easily in the summer, and supply single claims or little camps of no note, and so they are relatively of little importance to the mining industry of the country.

FLUMES.—Flumes are usually made with boards, an inch and a half thick for the bottom, and an inch and a quarter for the sides. At intervals of two and a half feet there is a support for the flume box, consisting of a sill, posts, and cap. The sills are four inches square; the posts three by four inches, and the caps one and a half by four inches. To erect a flume 25 feet high, costs about twice as much as to lay one on the level of the ground, and at 60 feet it costs four times as much. The annual repair of a flume is about one-eighth of its original cost, in favorable circumstances. If the flume is left dry several months, the repairs may be more, for the sun warps and splits the boards, and draws the nails. A flume box, 40 inches wide by 20 inches deep, with a grade of 13 feet to the mile, will carry about 800 inches, and such a flume built on the surface of the ground will cost now at the rate of $4,000 per mile, near a saw-mill. The boards are put in the flume rough, but are always battened, and sometimes caulked. The cheapest flume costs twice as much as the cheapest ditch of the same capacity, and the repairs of a flume cost 90 per cent. more than those of a ditch. The duration of a high flume is on an average about six years, and of a low one 8 or 10. For the first two or three years after the construction of a ditch there is much trouble from gopher holes and slides.

The flumes in the highest portions of the Sierra, and especially about Howland Flat and La Porte are much troubled by the snow, and much labor is spent on them every winter. The weight of the snow is so great that after every snow-storm, or while it is in progress, a man must go along and clear the flume with a shovel. In cases where the flume is on a hill-side it is necessary to shovel away the snow from the upper side of the flume, for the mass moves down hill with tremendous weight, though with very slow motion, and no flume could resist it.

IRON PIPE.—The use of iron pipe in the form of an inverted siphon, instead of high flume, for the purpose of carrying water across ravines, has been a great improvement and saving in the ditch business. Near Placerville, water is carried across a depression 190 feet, and 1,600 feet long, in a pipe that cost $900, whereas a flume would have cost $25,000. Not only is it cheaper, but it can be used where fluming is peculiarly impossible, as in crossing ravines 400 feet deep.

The sheet-iron used in making pipe comes in sheets two feet wide and six feet long. The common sizes of pipe are 7 inches and 11 inches in diameter, made in joints two feet long. A sheet makes two joints of 11-inch pipe, and three of seven-inch, and 11 joints are riveted together to make a section 20½ feet long. At the end of each section, as pipes are usually made, there is an ear or hook riveted on each side, and when the foot of one section is thrust into the head of another, a wire is wrapped round the opposite ears or hooks to tie the sections together. In case the pipe is laid on a hill-side running down, each section is tied at the head to a post to keep it in place; and the post may be supported by a board placed edgewise and crosswise in the ground. About an inch and a half of space is allowed for the lap at the end of the sections. The ends need to be made with precision, so that they will be water-tight, without packing. The pipe should be put together in a straight line, and the sections should be driven together with a sledge-hammer, striking a board laid across the end of the section. The pipe needs to be coated with tar to preserve it, and if very large it may be coated inside as well as out.

The cost of 11-inch pipe made of No. 20 iron is about 75 cents per foot. The thickness of the iron depends upon the amount of pressure and the size of the pipe. The larger the pipe the thicker the iron should be. The pressure at 190 feet is 88 pounds per square inch, and No. 20 iron is strong enough for that, if the pipe be not more than 11 inches in diameter.

The capacity of an inverted siphon depends mainly on the three elements of diameter, head and depression. The deeper the depression the greater the friction and the slower the current. A straight pipe 11 inches in diameter will carry five times as much water as an inverted siphon of the same size and head with a depression of 200 feet.

DITCH LAW.—The rules of the common law relative to the rights to water were unsuited to the wants of California, and therefore the courts have, by their decision, established a new code, which was original here. Among the principles of the California water code are the following:

The water of a stream may be led away from its natural bed and never returned.

Water becomes the property of the first claimant; but it becomes his property only for the purpose for which he claims it, and to the amount which he appropriates.

The holder of a claim has a right to use the water without any obstruction from later claimants, who may, nevertheless, use the water, if they return it clear and uninjured above the point where the first claimant takes it.

If a miner after claiming and using water abandons it, and allows it to run into a channel claimed by another, the latter becomes the owner.

If a ditch is cut for drainage alone, another may claim the water for mining.

When the waters of an artificial ditch are turned into a natural stream with the intention of taking out the same amount at a lower point on the stream, they may be so taken out, though the stream had already been claimed by another title.

No person has a right to take the water from the bed of a stream in which there is a prior mining claim that cannot be worked without the water.

Section 9 of the act of Congress of August, 1866, relative to ditch companies, makes a material change in the rights of ditch companies. It provides:

> That wherever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes aforesaid is hereby acknowledged and confirmed: *Provided, however*, That whenever, after the passage of this act, any person or persons shall, in the construction of any ditch or canal, injure or damage the possessions of any settler on the public domain, the party committing such injury or damage shall be liable to the party injured for such injury or damage.

Under this act a ditch company acquires a title to the land on which the ditch is made, and to as much more on each side as may be necessary for the safety or business of the ditch. The company has, beside, the right to run a ditch over mining claims and farms on the public domain, on the payment of the actual damage done. Previous to the passage of this act, if a ditch was located over a mining claim of prior date, the miner had a right to wash away all his ground, and if the ditch was damaged the ditch company had to bear the loss; but under the new law the ditch company has a better title than the mining claims of prior location; and if the miner washes away the ditch or injures it, he becomes responsible for the damage.

CONFLICT BETWEEN DITCHERS AND MINERS.—The first conflict or case under the law arose at Gold Run, in Placer county, where there was a large extent of ground suitable for hydraulic washing, but it remained long inaccessible for want of water or of outlet. Several ditch companies ran their ditches over mining claims, and the miners notified the ditch companies that the ground there would, after a time, be washed away. The ditch companies replied that they recognized the prior right of the miners and would move the ditches at their own expense when the washing should get near to the line. Before that time came, the act of 1866 was passed giving to the ditch companies superior rights. Early in this year one of the miners, over whose claim several ditches ran, notified the companies that he was rapidly approaching their lines with his pipe, and the bank would soon be washed away. One company replied that they would move at their own expense; another gave him notice not to come within 50 feet, or they would hold him responsible for all damage done. He has been compelled to stop because his profits would not have been large enough to cover the damage.

PROPOSED GRANT OF LAND ALONG DITCHES.—The ditch companies have solicited from Congress a grant of at least 100 feet on each side of their lines; and their wish upon this point deserves attentive consideration. If such a grant, at least along the main trunks where not less than 500 inches of water are carried for six months in the year without disturbing the claims of miners located previous to the location of the ditch, would encourage the construction of new ditches, or would give longer life or greater size to those now in existence, it would be politic. These companies, by whose assistance $700,000,000 have been taken from the ground, at a loss of $10,000,000 to themselves, deserve to receive some favors, which will cost nothing to the government, do no injustice to individual mines, and increase or keep up the supply of water.

Before the passage of the act of 1866, granting the right of way to the ditches, the Pacific Railroad act had been passed, giving to that road alternate sections of public land for a width of five miles on each side of the line, and thus the Central Pacific Railroad Company has become the owner of many miles of ditch belonging to different companies along its line; and although it has not seen fit to demand anything from them, still it is very unpleasant to the ditch companies to know that they are at the mercy of another association of later date. The act of 1866 giving a right of way for the ditch companies secures them against losing their lines by future railroad grants, but it leaves them subject to fears that the land immediately alongside may be taken in such a way as to prevent changes and improvements that might be required. In some places where there are high flumes a strip 100 feet on each side of the line would not be too much to be granted to the ditch companies; but in those places where there is a plain ditch or iron pipe on a plain surface, there would seem to be no good reason for granting more than room enough to drive a wagon along.

Measurement of Water.—Water is sold by the inch, and usually an inch is the amount which escapes through an orifice an inch square, with the water six inches deep above the top of the orifice. That is called a six-inch pressure. If a large quantity is sold, the orifice may be two or three inches high. The mode of measurement, however, is not uniform. In some places the pressure is nine or ten inches; in others there is no pressure but the quantity that escapes through an orifice an inch wide, and three inches high, without pressure, is called an inch.

In calculations made by machinists it is often necessary to use the term "an inch of water," and by common consent that phrase is accepted now to mean a supply of 4.032 cubic inches, or 145.86–100 pounds per minute; 3,360 cubic feet, 10,656 gallons in 24 hours; and 1,226,400 cubic feet, 30,410 tons of 40 cubic feet each, or 6,020,540 gallons in 365 days of 24 hours each. If an inch of water pass 200 feet fall it supplies an amount of power about one-tenth less than one-horse power.

At the last session of the legislature of California a bill was introduced to provide that "where the question shall be involved as to the quantity of running water sold, purchased, delivered, or used, and described by "miner's inch," it shall be held and declared that a 'miner's inch' of water shall consist of two and one-third cubic feet of water passing a given point in one minute of time, or seven and $\frac{4054}{10000}$ gallons of water passing a given point in a minute, or 145$\frac{86}{100}$ pounds of water passing a given point in a minute." The bill was referred to the committee on mines, which reported a substitute, providing that "a legal inch of water sold for mining, agricultural, or other purpose, is hereby declared to be what water may pass through an orifice of one inch square, through plank of one inch in thickness, with a pressure of seven inches measured from the centre of the orifice to the surface of the water: *Provided*, the water shall be delivered from a box in which the water has no motion except that caused by the flow of the water to be delivered from that particular box." Both the original bill and the substitute were indefinitely postponed. The objections to the substitute were that it might be as well to let the miners and ditch companies agree upon their measurements as well as upon their prices, and that some companies which had long adopted other modes of measurement would be inconvenienced.

Eureka Lake and Yuba Canal Company's Ditches.—The property of this company, under the present organization, is a consolidation of the ditch and mining property formerly owned by a number of different companies. It extends over a vast range of country, and embraces many valuable mines. The main ditches were constructed during the years 1855 to 1859, inclusive. Purchases of the smaller ditches and consolidation of the larger have taken place at different times during the last eight years; that between the Eureka Lake Water Company and the Middle Yuba Canal and Water Company was on the 1st of August, 1865. All the property of this company has since been transferred to a corporation organized for the purpose in the city of New York, the transfer having taken effect on the 1st of January, 1866. The following statement is derived from the superintendent, Mr. Richard Abbey: Capital stock, $2,250,000. The first cost of construction of all the works would be difficult to estimate, but would probably not fall far short of $2,000,000. The cost of the Eureka Lake Water Company and Middle Yuba Canal and Water Company's property was $1,600,000; length of main ditches and flumes, 100 miles; supplemental, 60; capacity, 5,000 inches. Estimated amount of gold taken out by the miners supplied with water by this company during the last five years, $2,000,000 per year.

Mr. George Black, civil engineer, thus describes the district of country through which these remarkable ditches run, the prevailing systems of mining, and the costs and profits:

> The mining section of country supplied by the Middle Yuba canal is situated in the northwest of Nevada county, and commences at North San Juan; it thence extends, on the south side of the Middle Yuba river, to its junction with the Main Yuba; thence, on the southeasterly side of the Main Yuba, by Sebastopol, Manzanita Hill, Sweetlands, Buckeye, Birchville, and French Corral, a distance of about six miles.
>
> At Junction Bluff, a spur from Manzanita Hill, the Middle and North Yuba rivers join together and flow in a southwesterly direction, for a distance of about eight miles, to the junction of the South Yuba, at Point Defiance, three miles below French Corral.
>
> From San Juan to a point about a quarter of a mile below Junction Bluff, the north edge of the mining ground is at a distance of about half a mile from the river, and at an elevation of about 800 feet above it, having a gradual inclination to the water's edge. From this point to French Corral a slate ridge of hills extends between the northwest side of the mining ground and the river. On the south it is bounded by a low ridge of hills, which extend to the South Yuba. Along the north and west sides of these hills, and in the intervening valleys, part of the company's main canal is situated, together with the branches and reservoirs belonging to it.
>
> The mining ground from San Juan to French Corral is composed of a succession of gently rounded gravel hills, in length from one mile to one mile and a half each, separated by ravines; the width is more contracted in some places than in others; on an average, it may be taken at 1,500 feet. The depth along the centre varies from 150 to 200 feet, diminishing towards the sides. The deposit rests on a basin-shaped depression in the bed rock, which is composed in some places of granite, in others of either trap or transition slate. In those places where the superincumbent gravel has been washed away the bed rock is exposed to view, and presents a similar appearance to that of the present river, which flows several hundred feet beneath. The water-worn appearance of the rocks, all the angles and projecting points of which have been rounded off, show very plainly that at one time a powerful current of water must have swept over them.
>
> The gravel hills are composed of layers (in some places almost horizontal) of sand and gravel, intermixed here and there with streaks of clay. The upper layers are composed of sand and fine gravel; the gravel becomes coarser as the depth increases. The lower portion is composed of boulders and gravel cemented together into a hard and compact mass, resting on the bed rock. Gold is found throughout the whole of this deposit; the upper 50 or 60 feet contain it only in very small quantities; it increases with the depth, the lower 20 to 30 feet lying above the bed rock being invariably the richest. The gold is what is usually termed "fine," being in very minute scales, in some cases almost resembling the fineness of dust. Large and coarse gold is rarely met with in this locality.
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> * * * * * * * * *
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> Gold mining was at first only carried on in the beds of rivers and ravines or along their banks, where coarse gold was found, with comparatively little labor or expense in the extraction of it. When these places were partially exhausted the attention of miners was turned to deposits such as these under notice, which could only be made available by a large supply of water, brought in over the mining ground at a high elevation. It was to attain this object that a number of miners joined together in 1853 and organized the Middle Yuba Canal Company, and commenced the construction of their works. When they were completed, a new system of working was inaugurated here, by which water was made to replace the labor of men. Practical experience has since then proved that the more water is used the more economically and effectually can the deposits be worked. The water is conducted from the flume or ditch into the measuring box, 12 to 14 feet square, in the side of which openings are left two inches in depth, and extending along all the sides. The water is allowed to attain a depth of six inches above the centre of these orifices. The measurements are made according to the sectional area through which the water flows; for instance, 20 inches in length by 2 inches in depth is called 40 inches in miners' measurement; 50×2=100, and so on. The discharge is regulated according to the demand, and is allowed to flow during a working day of 10 hours. A cubic foot, or 7.49 U. S. gallons, equals 38 miners' inches.
>
> The water from the main canal, or from the reservoir, is carried over high flumes and in branch ditches to the different hills, where measuring boxes are fixed to receive it; from these boxes it flows through pipes to the different companies at work. The main pipes at present

used are made of sheet iron one-sixteenth of an inch in thickness, firmly riveted together; (8,000 feet of pipe are in use on the different hills.) The lengths are usually about 12 feet; the diameter from 11 to 18 inches. The main pipe is connected to a cast-iron box, placed as low down as circumstances will admit; to this box pipes of a lesser diameter are attached, at different sides, so that the water can be thrown on different points. At the extremities of these pipes flexible tubes are fixed, to which are attached nozzles with metallic ends. The diameter of their orifices is two to three inches. The nozzles are pointed against the bank which has to be removed. The water used varies from 200 to 1,000 inches; 1,000 inches, miners' measurement, equals 26¼ cubic feet, or 197 U. S. gallons; in weight, 1,630 pounds; being a constant discharge, under pressures varying from 140 to 200 feet. This colossal force brought to bear against the banks cuts and breaks them away to within a few feet of the bed rock. Blasting is resorted to to break up the cemented gravel; sometimes long drills and sand blasts are used, with only a small quantity of powder. Where the crust to be removed is too thick for this a drift is run in a little further than the height of the bank, and from 1 to 20 kegs of powder are used, according to the depth of the bank to be lifted.

In the centre of the hills the hard gravel is generally from 20 to 50 feet in depth. A drift is run in on the bed rock, and from 50 to 175 kegs of powder are used at one blast.

Some miners think it more economical and profitable to drift. They construct parallel tunnels 100 feet apart on the bed rock, six to seven feet in height, running into the cliffs, and connect them together with cross-drifts. The connecting walls are washed away by hydraulic power, which causes the entire cliff to settle down and break to pieces in its fall. The water is then brought to bear on this mass with such force that it sweeps everything away through tunnels constructed in the bed rock. Timber sluices are laid through these tunnels, varying in width from two and a half to four feet, and 18 inches in depth. The grade is usually 1 foot in 15. Two sluices are sometimes used in the same tunnel by different companies, from two to two and a half feet in width each. Larger sluices and heads of water, with a smaller grade, seem latterly to be preferred as more efficient.

Several methods are in use for the effectual saving of the gold. In some places the bottoms of the sluices are paved with rounded stones of oblong shape, the lesser diameter being about three inches. The gold, as it is carried along, is deposited in the interstices between them. A "clean up" is made in every 10 or 20 days. In other places blocks are used, sawn across the grain, and about two feet square and six inches in depth; a batten two inches wide and two inches in depth is placed between them across the flume, which forms a hollow of four inches in every two feet; in these crevices the gold is deposited. These blocks, of course, wear out very rapidly, and have, about once in every two months, to be replaced. The velocity of the water is so great that rocks weighing from 100 to 150 pounds are often carried along by the current through the tunnels. The entire mass is precipitated over falls from 12 to 20 feet in height, which breaks up the boulders and cement; the fragments are taken up anew by other sluices, again precipitated over falls, which operation is repeated several times before the river is reached, several hundred feet below. In several places under-current sluices are used. At the end of and in the bottom of the last sluice-box a grating is constructed of iron bars, through which a portion of the fine gravel, clay, sand, and water is separated from the larger particles, and drops into a set of more gently-graded sluices underneath, varying in width from six to eight feet, through which they are carried off by the current in one direction, while the main body of gravel and boulders is dashed over the falls, to be again taken up by other sluices, along with the tailings from the under current, and subjected anew to the same operation, which is thus repeated several times before the river is reached.

To show the enormous advantages gained by the present system of working, compared with those formerly in use, I may add that, taking a miner's wages at $4 per day, the cost of extraction of a cubic yard of deposit will be as follows:

With the pan	$20 00
With the rocker	5 00
With the Long Tom	1 00
While with the powerful means now employed it is only	20

A considerably greater quantity of gold is retained by this operation than by any other hitherto employed. Quicksilver is used more by some miners than by others, distributed through their sluices so as to form an amalgam with the gold. They have no fixed rule to guide them in its use.

The works of the Middle Yuba Canal Company were commenced by the construction of a small ditch from Grizzly cañon (a small stream which falls into the Middle Yuba) to San Juan. The water supply not being sufficient, the ditch was enlarged in 1855 to its present size, while the works were extended from Grizzly cañon to the river, across which a small dam was built. It is situated about three miles below Moore's Flat, the latter place being, in altitude, about 1,500 feet above it. The distance from the dam to San Juan is 22 miles, and four miles further to the termination of the main canal, at the Sweetlands creek reservoirs.

Four receiving reservoirs hold the water which flows at night and on Sundays—

San Juan reservoir, having a capacity of discharge of	2,300 inches.
Manzanita Hill reservoir, having a capacity of discharge of	2,000 "
Northrup reservoir, having a capacity of discharge of	2,500 "
Garden reservoir, having a capacity of discharge of	2,000 "
Total	8,800 "

The various hills are supplied either by branch ditches from these reservoirs, or directly from the main canal.

The branch ditches are connected with high flumes which span the low ground intervening between the ridge and the mining ground. At San Juan a high flume connects with the main canal.

The length and greatest height of these flumes are as follows:

	Length.	Height.
	Feet.	*Feet.*
San Juan aqueduct	1,200	48
Mazanita Hill aqueduct	2,000	54
Buckeye Hill aqueduct	400	35
Birchville Hill	1,000	40

The aggregate length of the branch ditches is about 12 miles.

The dimensions of the excavated part of the main canal is as follows: bottom, four feet; top, seven feet; depth, three feet; the grade from the dam to Grizzly cañon is 10 feet per mile, and from there to San Juan, 12 feet per mile.

The dimensions of the ditch from San Juan to Garden reservoir are: bottom, three and one-half feet; top, six feet; depth, two and one-half feet; grade, 12 feet per mile.

The main flume is of the following dimensions: bottom, four feet; depth, three feet, with same grade as ditch.

The branch ditches are: bottom, two and one-half feet; top, four feet; depth, two feet; grade, 12 feet per mile.

The safe capacity of the canal, as it is at present, is equal to a constant stream of 1,500 inches for 10 hours, miners' measurement, or 3,600 for 24 hours = 38 cubic feet per second.

The cost of the works has been as follows:

Construction of canal from river to Mazanita Hill	$261,765 83
Construction of canal from Mazanita Hill to Birchville Hill, together with purchase from Sweetlands, &c	31,237 50
Expenses and improvements, to May, 1857	70,954 29
San Juan, Mazanita, and Jones's reservoirs	18,099 29
Purchase of Grizzly Company's works, at San Juan	10,000 00
Purchase of Pollard's, at Buckeye Hill	1,500 00
Sandy creek extension	3,625 00
Total cost to June, 1858	397,201 91

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Water sales, receipts and expenses of the Middle Yuba Canal Company, from January 20, 1856, *to July* 1, 1864.

	Sales.	Receipts.
January 20, 1856, to December 1, 1857	$164,834 45	$142,615 48
December 1, 1857, to January 1, 1859	167,113 58	148,689 74
January 1, 1859, to January 1, 1860	172,432 54	144,375 39
January 1, 1860, to January 1, 1863	378,940 78	369,577 81
January 1, 1863, to January 1, 1864	123,153 80	109,480 87
January 1, 1864, to July 1, 1864	68,726 01	62,283 43
	1,075,201 16	968,022 72

Expended in construction of extension ditches, reservoirs, and other improvements, and working expenses in three years, ending January 1, 1863, $132,535 70.

Statement of water sales, receipts and expenses from January 1, 1863, *to June* 30, 1864.

Date.	Sales.	Receipts.	Working expenses.					
			Officers and water agents' salaries.	Ditch tenders' wages.	Wages for repairs and improvements.	Lumber and nails.	Sundry expenses.	Total expenses.
1863.								
January	$10,819 40	$9,204 04	$650	$700 00	$242 75	$915 46	$34 25	$2,542 46
February	7,497 20	8,358 76	650	700 00	212 50	48 04	114 00	1,724 54
March	11,522 40	6,981 36	600	700 00	243 87	5 61	8 00	1,557 48
April	10,998 00	7,963 02	625	625 00	130 75	81 87	39 50	1,502 12
May	14,124 60	6,077 40	650	607 00	467 63	69 72	....	1,794 35
June	10,333 80	9,368 70	600	535 00	226 75	20 75	....	1,382 50
July	8,352 30	6,198 93	650	457 50	97 31	164 40	176 25	1,545 46
August	12,941 20	7,895 48	650	415 00	334 65	745 75	64 00	2,209 40
September	10,144 30	8,159 41	550	415 00	69 00	102 17	452 50	1,588 67
October	10,351 60	8,900 45	575	700 00	7 50	30 75	20 00	1,333 25
November	5,926 20	9,025 66	650	415 00	267 63	567 48	4,280 18	5,980 29
December	10,142 80	12,347 06	615	415 00	52 00	44 30	2 00	1,128 30
1864.								
January	11,011 80	10,615 92	650	415 00	247 77	113 76	409 72	1,836 25
February	7,863 20	5,678 24	650	415 00	710 62	169 05	515 90	2,400 57
March	10,200 60	5,955 87	650	405 00	539 62	29 06	9 75	1,633 43
April	16,165 30	22,882 05	650	405 00	234 80	250 64	2 60	1,542 44
May	10,666 45	8,429 63	625	405 00	157 74	69 28	51 50	1,308 52
June	12,818 66	8,721 72	650	405 00	87 75	169 57	122 75	1,435 07
Total	191,879 81	162,764 30	11,340	9,134 50	4,330 64	3,397 66	6,302 20	34,505 10

The expense of $5,980 29, in November, 1863, includes State and county taxes.

It will be seen from the foregoing statements that the actual receipts for the sales of water, from 1856 to July 1, 1864, a period of eight and one-half years, have amounted to $968,022 72.

The receipts from January 1, 1860, to January 1, 1863, (three years,) have amounted to	$369,577 81
While the expenses have been	132,535 00
Net receipts	237,042 81

And the receipts from January 1, 1863, to July 1, 1864, (one and one-half year,) have amounted to	$162,764 30
Expenses	34,505 10
Net receipts	128,259 20

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In addition to the supply derived from the Middle Yuba, the canal also receives part of the water from the reservoir of the Sierra Nevada Lake Company, which, after being used on American Hill, Chips, Alleghany, and Minesota, falls into the river or its branches, and flows from thence into the flume

In like manner the water in Eureka Lake Company's reservoir, after being used at Snow Point, Moore's, Orleans, Woolsey's Flats, and at other points along the north side of the ridge, falls into the river, and also flows into the flume.

Very extensive mining operations have been carried on for some years on this section. Tunnels, amounting in the aggregate to thousands of feet in length, have been driven through the bed rock to insure the fall necessary for the sluices. These tunnels have cost from $15 to $25 per foot run; some have taken years to complete, while others are still in course of construction.

SAN JUAN HILL.—The Eureka Claim embraces 80 claims of 180 feet by 80 feet—consequently an area of 26¼ acres. The depth of the gold-bearing deposit is 100 feet to 175 feet. The north edge of the granite basin on which it rests is at an elevation of 850 feet over the Middle Yuba, which flows beneath. 500 to 1,000 inches of water per day, supplied by the Eureka Lake Company, are used through three iron pipes 12 inches to 14 inches in diameter.

Upwards of five years—from August, 1855, to October, 1860—were taken to construct a tunnel so that the gravel could be worked to the bed rock. The expenses incurred before a dividend was declared were $142,000.

The expenses of working this claim from July 24, 1860, to December 21, 1862—two and one-third years—were as follows:

Canvas and hose	$4,654
Purchase of claims	22,800
Water	67,800
Labor, quicksilver, tools, &c	51,952
Lowering tunnel	20,000
Lumber	6,400
Powder	20,000
	193,600
Proceeds from claims	287,200
Net profits	93,600

During the period of two and one-third years, eight months were lost in lowering the existing tunnel, so as to obtain the requisite fall for the flumes.

December 21, 1862, to April 1, 1863—three and one-fourth months:

Expenses for water	$11,000
Labor, quicksilver, &c	8,000
	19,000
Proceeds from claims	50,000
Net profits	31,000

In June, 1863, this company was regularly incorporated, and the office established in San Francisco. The following is a detailed account of expenses and receipts since then:

Receipts and expenditures of the Eureka Gold Mining Company's Claim from June 5, 1863, to August 11, 1864.

August 11, 1864:	
Cash, labor account	$24,986 56
Expense, lumber, candles, coal, merchandise, incidentals	4,568 42
Claims account	602 50
Hose	1,488 10
Powder	9,642 17
Water	35,782 49
Quicksilver	272 81
Taxes	108 40
Dividend account	66,000 00
Balance	4,078 45
	147,529 90
August 11, 1864:	
Cash received from claims from June 5, 1863, to date	$147,529 90

SAN JUAN HILL.

Deadman Cut Mining Claims—superficial area, square feet	94,623
Average depth, feet	100
Cubic contents, cubic yards	350,455

April 29, 1855, to February 4, 1859:	
Water	$23,565 76
Special expense	20,017 78
Labor	27,849 75
	71,433 29
Cash received from claims	156,307 73
Net profits	84,874 44

This claim was entirely worked out in 1859.

The average quantity of gold in it was, per cubic yard	.44
The total cost of extracting, including water, per cubic yard	.20

MANZANITA HILL.

McKeeby & Company's Claims, average length 851 feet by 315 feet, square yards		28,240
Average depth, feet		120
Amount of gravel, cubic yards		1,191,400
Cash received from claims		$368,932 78
Construction of tunnel	$18,000 00	
Water	81,555 25	
Expenses	142,717 53	
Dividends paid	126,660 00	
		368,932 78

This claim has been in operation since 1855. The total quantity of water used has been 339,374 inches, the price of which has varied from 50 cents to 20 cents per inch. The average quantity of gold, 30 cents per cubic yard. Cost of water, 7½ cents per cubic yard. Total cost of extraction, including water, 20 cents. The shaft sunk from the surface of the bed rock to the sluice is 169 feet 10 inches. The size of the claims is 180 feet by 80, or one-third of an acre in area, (each company owning several claims.) The average quantity of water required for the complete working of each has been 18,614 inches; at 20 cents per inch, $3,722.

The Middle Ynba Company's receipts over expenses for 12 months ending July 1, 1864	$85,506
The Eureka Lake Company's receipts over expenses for 12 months ending July 1, 1864, were, say	145,000
Net receipts	230,506

* * * * * * * *

The safe capacity of discharge of the canals of both companies, being a constant stream during 10 hours, is as follows:

	Miners' inches.	
Eureka Lake canal	3,000	
Miners' canal	750	
Other districts	250	
		4,000
Middle Yuba canal		1,500
		5,500
5,500 inches for ten hours, equal for 24 hours		13,200
20 per cent. deficiency in supply, stoppages, and other causes		2,620
		10,580

Say 10,000 inches per day, &c.

* * * * * * * * *

In reference to the Eureka Lake canal, Mr. Black makes the following remarks:

The section of country which can be supplied by these works extends over a large portion of Nevada county, commencing at the junction of the North and South Yuba rivers, four miles below French Corral; thence it extends in a northeasterly direction between these rivers toward the summit of the Sierra Nevada. A main ridge between these rivers gradually rises from 1,500 feet, the altitude of French Corral above the sea, to 8,000 feet on the summit. Numerous lateral spurs, with ravines separating them, extend from the main ridge on each side to the rivers. In most cases the mining ground is situated on benches near the extremities of these spurs; in some, however, it is situated in channels between them. From French Corral to Eureka, a distance of about 32 miles, the average width between the rivers is seven miles; from thence the width gradually increases to about 16 miles on the summit of the mountains. The first portion is that in which the mining section is situated, and comprises an area of about 175 square miles. The area of the different places where gravel deposits have been found may together be about 15 square miles. The deposits in addition to those from French Corral to San Juan, already described, extend on the north side of the ridge by Badger's Hill, Grass Valley, Eurisko, and further up by Woolsey's, Moore's, Orleans Flat, and Snow Point to Eureka; and on the south slope of the ridge from Montezuma to Pleasant Hill, Cherokee, Chimney Hill, Columbia Hill, Lake City, Bloomfield, Relief Hill, and Mount Zion. The thickness of the deposits varies from 60 to 200 feet, nearly similar to those before described at San Juan, save that they are not so rich in gold, and are more intermixed with seams of clay, which render them more difficult to be worked.

From Eureka to the summit of the mountains no deposits have been found. The geological formation is mostly granite and gneiss, which rise into high and rugged peaks, some of which attain an elevation of 8,500 feet above the sea. The Middle and South Yubas, with their tributary streams, such as Cañon creek, Pass creek, and others, take their rise in these mountains, amongst which are numerous lakes from 20 to 400 acres in area. The Cañon Creek lake, situated at the head of Cañon creek, about four miles west of the summit, is the largest, and forms the company's principal reservoir. A substantial dam formed of blocks of granite has been erected across its outlet. The transverse width at bottom is 120 feet, its height 70 feet, and length from bank to bank 250 feet. The front is protected with two layers of 2½-inch lumber, well secured to the face. An arched sluice is constructed through the dam, by which the flow of water is regulated from the interior. When full of water, the area of the reservoir is 500 acres, the average depth of water 42 feet, and its contents 935,000,000 cubic feet of water.

Sources of supply, from the middle of April to the middle of August, are derived from the mountain streams, which become swollen from the rapid melting of the snow, and afford a four months' plentiful supply. After that date recourse is had to the reservoirs.

MINERS' DITCH.

Cost of purchases of ditches and water rights	$57,900
Miners' ditch and reservoirs cost	180,000
	237,900

EUREKA LAKE DITCH.

Cost of purchase of small ditches, water rights, &c	174,250
Eureka Lake dam	35,000
Lake Faucherie dam	8,000
Smaller dams	2,000
Magenta and National aqueducts	23,000
Storage reservoirs	51,000
Iron pipes to San Juan	12,000
Main canal and flume	256,000
Saw-mill	7,000
	806,150
Management, law expenses, &c., 20 per cent	161,230
	966,380

The following is a list of the storage reservoirs named in the above estimate, with their capacity and cost:

Locality.	No. of reservoirs.	Capacity in inches.	Cost.
Eureka	1	50	$300
Snow Point	1	2,500	1,000
Orleans	4	500	3,000
Moore's	4	800	6,000
Woolsey's	3	1,000	7,500
Relief Hill	1	300	1,500
Bloomfield	3	500	1,500
Lake City	2	2,000	5,000
Kennebec	1	250	1,500
Grizzly Hill	1	100	1,000
Columbia Hill	3	4,500	15,000
Grizzly Hill	1	4,000	10,000
Cherokee	2	500	4,000
Lone Ridge	1	700	2,500
San Juan	2	3,000	10,000
Pleasant Ridge	1	250	1,000
Montezuma	2	200	1,000
	33	21,150	71,800

The average annual water sales of the Eureka Lake Water Company, according to the annexed statements, amount to $161,369, over and above expenses of management, repairs, &c. Deducting 10 per cent. from this for bad debts will leave a net income of $145,233.

Some idea of the magnitude with which mining operations are carried on along this ridge may be inferred from the fact that since 1850 the annual quantity of gold transmitted to San Francisco has amounted to from $1,500,000 to $2,000,000.

So great has been the quantity of ground washed away, that many of the ravines are covered with a depth of 20 feet and upwards of tailings from the sluices, composed of sand and gravel. The fall, therefore considered necessary for the sluices, of one foot in 15, can only be obtained in those places that are situated above the rivers, such as those in the San Juan district, and higher up the ridge at Badger Hill, Grizzly Hill, Woolsey's, Moore's, and Orleans Flat.

In order to obviate this difficulty of want of fall, tunnels are being constructed at different points, which take from two to five years to complete. Some of those I visited are through granite or trap, and cost at the rate of from $20 to $60 per running foot. They are six to eight feet in width, and seven feet in height; when completed a flume will be laid through them and extended a long distance down the ravine. All the tailings with which a ravine is incumbered will be carried away through the flume by the current of water. After the present year, many of those tunnels now being constructed will be finished, when numerous companies will be enabled to work, which are now precluded from doing so on account of insufficiency of fall in the creeks.

I annex a detailed statement of the localities supplied by the Eureka Lake Water Company, and the amounts realized during one week; it is a fair average statement of the weekly sales during the year.

Water sales of the Eureka Lake Water Company for the week ending July 5, 1862.

Lake City, Grizzly Hill, and Kennebec	$175 00
Snow Point	62 16
Woolsey's	407 09
Moore's	243 84
Orleans	169 14
Pleasant Hill	32 50
Cherokee	258 02
Bloomfield	10 59
San Juan	1,305 67
Columbia Hill	853 83
Chimney Hill	484 35
Relief Hill	212 17
Eureka	61 50
	4,189 77

Abstract of monthly reports by secretary of the Eureka Lake and Yuba Canal Company.

	Water sales.	Receipts.	Expenses of regular employés.	Expenses of repairs, &c.	Due for water.	Cash, net receipts.
1866—January	$10,079 51	$4,856 71	$3,142 17	$895 36	$5,235 01	$10,476 86
February	25,965 33	13,740 97	3,107 58	976 71	12,242 11	
March	30,173 51	27,109 38	3,615 92	1,019 05	3,065 76	22,474 41
April	24,866 78	26,496 69	3,479 15	2,855 27	18,946 37	10,247 73
May	21,823 65	17,898 09	3,563 49	4,086 87	22,871 93	24,551 72
June	27,715 34	30,537 58	3,573 66	2,416 20	20,049 69	7,128 63
July	23,975 24	14,259 98	3,366 30	3,802 05	29,674 95	13,612 47
August	20,392 41	19,705 42	3,462 29	2,740 31	30,361 94	14,581 01
September	26,093 80	20,873 18	3,358 55	3,103 99	35,582 36	15,945 97
October	21,836 95	25,692 60	3,317 49	6,966 90	31,726 71	4,366 78
November	18,474 98	17,028 62	3,392 99	9,700 96	33,173 07	15,442 78
December	19,500 32	21,812 66	3,502 97	3,059 87	30,950 73	
	270,897 82	240,011 88	40,954 56	41,623 54	....	158,989 23
1867—January	17,615 69	16,611 30	3,633 74	387 04	22,705 36	13,112 87
February	16,989 64	12,995 83	3,187 32	1,427 68	26,699 17	8,956 81
March	20,524 74	17,104 16	3,155 96	338 93	30,119 75	12,166 89
April	23,027 48	22,791 20	3,361 01	1,782 76	30,356 03	17,647 43
May	19,475 72	22,375 81	3,559 99	3,040 33	27,498 81	15,775 49
June	25,353 35	23,944 15	3,566 82	3,276 65	29,192 97	17,100 68
July	18,138 69	15,518 00	3,515 49	2,237 11	31,813 66	8,765 40
August	25,114 14	22,935 76	3,463 50	2,374 10	33,992 64	17,098 16
	166,239 45	154,276 21	27,443 83	15,864 60	....	110,623 73

FRENCH CORRAL.—The Nevada Water Company was organized and incorporated in New York in November, 1858. It then purchased the Shady Creek and Grizzly ditches, and now owns, in addition to these ditches, a large extent of mining ground. The Shady Creek ditch was located in January, 1851, and the Grizzly ditch in 1852. Both were constructed for the purpose of conveying water from Shady creek (a tributary of the Yuba river) to French Corral.

The Shady Creek ditch, the only one in present repair and use, has a running capacity of about 2,500 inches, miner's measure. Its width is eight feet at the top and six feet at the bottom, and its depth three feet, having a grade of about 14 feet per mile. Its length is about 12 miles, and with the exception of some 4,000 feet of fluming is excavated wholly in earth. The cost of construction of ditches and reservoirs owned by the Nevada Company has been about $150,000. They pass through Birchville mining district, but at present only supply water to the French Corral district. Six or eight sets of claims in this district besides the claims owned wholly or in part by the Nevada Company are supplied from their ditches.

Another ditch from Shady creek to French Corral, built in 1855, at a cost of some $50,000, including reservoirs, having a capacity of about 500 inches, is owned by the Empire Tunnel Company of this place. The principal claims in the French Corral district are the Kate Hayes Company, Bird & Smith, Black & Brother, Empire Tunnel Company, Empire Flat Company, Dockum Company, French's, Glaister's, Burke & Company, and the Nevada Water Company claims.

The price paid for water is 15 cents per inch, and the quantity used by different companies varies from 200 to 1,000 inches per day.

The gold range of this district is a deposit of washed gravel filling a well-defined old river channel to the average depth of about 150 feet, varying in width from 1,000 to 3,000 feet. This deposit is continuous from French Corral to San Juan, a distance of six miles, broken only by ravines, but below French Corral and above San Juan it is cut off by the deep cañons of the South and Middle Yuba rivers. This deposit is composed of what the miners call *blue* and *red* dirt—the blue gravel or cement underlying the red or gray. Both strata have until recently been worked by blasting with powder and washing by the hydraulic process. Hereafter it is believed that the blue cement will be crushed with greater profit, besides saving a larger percentage of gold lost by the ordinary washing.

The Empire Tunnel Company have built and are running very successfully a 10-stamp mill, crushing the blue cement. The American Company, at Sebastopol, are also realizing profits from their eight-stamp mill, working the same blue gravel.

The English or "Truckee Ditch Company," some 10 or more years ago, expended nearly $1,000,000 in a ditch from the Middle Yuba to the mines on the dividing ridge between the Middle and North Yubas. The enterprise proved disastrous for the reason that paying hydraulic mines could not be found. The gold deposits of that region were generally found in a thin stratum of gravel lying on the bed rock, while the mass of earth above contained little or no gold. The paying lead could be most readily worked by "drifting out," and required but a small amount of water to wash it. Under such circumstances an extensive and expensive ditch like the Truckee Company's would not pay, and has fallen into disuse. Their water right has recently been purchased by some San Francisco capitalists.

TUOLUMNE DITCH.—Most of the ditch water used in Tuolumne county is supplied by the Tuolumne County Water Company, which takes its water from the Stanislaus river about 20 miles in a direct line above Columbia. The company own two ditches known as "the old" and "the new." The former cost $550,000, and the latter $1,000,000. The old ditch was commenced on the 1st July, 1851, and it began to supply water in May, 1852, but the price of water, introduced at such great cost, was necessarily high, and the miners formed a combination to compel a reduction of prices and afterwards to construct a new ditch. The ditch was made, but in a very expensive manner, and when completed it was burdened with debt, so that it soon fell into the hands of those who owned the old ditch, leaving many of the creditors unpaid. A bitter feeling ensued and many threats of assassination were made, and the ditch and flumes were maliciously injured in numerous places. Although the new ditch was purchased at a small percentage on its cost, it did not pay much profit. Part of it was built on the side of a mountain which is swept nearly every winter by snow avalanches, and the repairs were very expensive. Forty miles of the ditch near the head are now abandoned. The company has 75 miles of main ditch and branches. The river supplies an abundance of water till the 1st July, and after that time the reservoirs are drained gradually. One of them covers 84 acres, and another is a mile long, three-quarters of a mile wide, and 40 feet deep. The total capacity of the reservoirs is 1,800 inches for four months, in which time they are exhausted, so that there is usually a month or two at the end of the dry season when the company cannot supply water. The ditch has a grade of 18 feet to the mile, and the flume is seven and one-half feet wide, four feet deep, and has a grade of 16 feet to the mile. The price for a 12-inch stream is $3 per day; of 15 inches $3 50; of 18 inches $4; of 21 inches $4 50; of 24 inches $5; of more than 24 and less than 48, 20 cents per inch; of more than 48 inches 18 cents per inch. The capacity of the flume is 3,600 inches. In many places flumes were constructed where it would have been much cheaper to have had iron pipe, and this is being substituted now as the flumes give way. Not less than $100,000 might have been saved by using pipe at first. The company supplies Columbia, Yankee Hill, Gold Springs, Mormon Gulch, Saw Mill Flat, Martinez, Jamestown, Montezuma, Chinese Camp, and their vicinities. The amount paid by the company as dividends in 1866 was $35,750.

PHŒNIX DITCH.—The Phœnix Ditch Company obtains its water from the Tuolumne river in two ditches, known as the Phœnix and Hydraulic, and supplies Sugar Pine, Soulsbyville, Sonora, Shaw's Flat, Poverty Hill, Algerine, Cherokee, and Somerville. The company has 84 miles of ditching and 16 miles of flume. Both ditches were started in 1850 and supplied water in small quantity the next year, but the Hydraulic did not get water from the Tuolumne river till 1853, nor the Phœnix till 1854. The highest flume is 65 feet high and 360 feet long, and it has been blown down once. The flume at Shaw's Flat, 300 feet high and 600 feet long, has been blown down twice. The flume of the Phœnix line is five feet wide by two and one-half deep; that of the Hydraulic four feet wide by two deep. There are two reservoirs which hold a supply for two months and a half. The price for a 15-inch sluice is $2 per day of 12 hours. The Phœnix ditch cost $380,000, and the Hydraulic $500,000. Both have been sold twice at sheriffs' sale. The receipts of the ditch company were $38,000 in 1860, and $22,000 in 1866, and the annual expenses are about $9,600. There are nine ditch tenders and collectors, who are paid $70 and $80 per month. In 1855 the price of water was $6 per day for nine inches. The water is delivered through an orifice three inches high and under a pressure of four inches over the orifice. There are near Cherokee and Somerville some high gravel hills, which may require a large supply of water when they are opened and their wealth demonstrated. About one-fourth of the water is sold to Chinamen, and one-twentieth for irrigation.

The Golden Rock ditch, south of the Tuolumne river, from which it obtains its water, supplies Gravel Range, Big Humbug, First Garrote, Second Garrote, Deer Flat, Big Oak Flat, Moccasin Creek, Spring Gulch, Boneyard, Peñon Blanco, and Horseshoe Bend. This ditch cost $300,000, and is very unprofitable. There is a flume 1,300 feet long, and part of it is 256 feet high, supported by wooden towers. The main ditch is 38 miles long. The price is $2 per day for a stream of 20 inches.

MURPHY'S DITCH.—The Murphy's ditch was commenced in 1851 and finished in 1856. The total cost was $260,000, of which sum $180,000 was obtained by the sale of water. Five years after the work was commenced dividends began to come in, and twice as much was received by the shareholders as they had paid out four years before. In 1866 $10,000 were paid as dividends, and the Calaveras ditch was bought for $20,000. The present market value of the ditch is probably not more than one-sixth of its original cost. The Caleveras ditch obtains its water from the Stanislaus river, and supplies Douglas Flat, Vallecito, French Flat, and Jenny Lind and Quail Hill. It was finished in 1858, and cost $10,000. Connected with this ditch is the Salt Spring reservoir, which covers 2,000 acres and is 30 feet deep, and is the largest reservoir in the foot hills of California.

MOKELUMNE DITCH.—The Mokelumne Hill and Campo Seco ditch has 50 miles of main ditch, and cost, when constructed, $500,000. The present assessed value is $25,000. The flume is 40 inches wide and 20 deep, and has a grade of 13 feet to the mile. Originally it was all flume, but the fluming has been replaced by ditching, except for six miles, and most of that distance will be ditch. The water is obtained from the south fork of the Mokelumne river. The places supplied are Mokelumne Hill, Campo Seco, Chile Camp, Rich Gulch, and Comanche Camp, and Cat Camp is to be supplied soon. In the extension of the ditch to the last-named place a depression 5,000 feet long and 80 feet deep is to be crossed by iron pipe two feet in diameter, with 30 feet head. It is expected that the pipe will carry 1,000 inches of water. The charge per inch is 25 cents for 12 hours to placer miners, and 15 cents per inch to quartz miners and millers. The water is discharged under four inches of pressure.

The Union Water Company's ditch is 35 miles long and takes water from the Stanislaus river to supply the placers' mining district between that river and the Calaveras, an area of 20 miles square. There are reservoirs large enough to hold a supply of 600 inches of water for three months.

AMADOR DITCH.—The Amador Canal Company has two ditches, the Amador and the Pioneer; the main trunk of the Amador is 20 miles long, all of it flume. The water is obtained from the Mokelumne river. The original length was 31 miles, but the upper part was so much injured in 1862 that 11 miles were abandoned and will probably not be rebuilt, or at least there is no thought now of rebuilding. Ditch might be substituted for flume for at least half the distance, and the substitution is to be commenced soon, since portions of the flume will not last long. The ditch carries 400 inches of water during eight or nine months of the year, but previous to 1862 that quantity was furnished the year round. There are parts of the ditch on which the charge for water is 10 cents per inch in winter and 15 in summer, and on the other parts the price is 16⅔ cents throughout the year. The gross income in 1866 was $28,000; and the ordinary expenses $20,000; and the extraordinary improvements $8,000, leaving nothing for dividend.

The VOLCANO ditch has 35 miles of main trunk, and obtains its water from its tributaries of the Mokelumne river. It carries 450 inches of water, but the supply ceases in July. The price for water is 12½ cents per inch per day. The cost of the ditch was $140,000. The gross receipts in 1866 were $5,000, and the ordinary expenses $3,000.

As the mines at Volcano were in a basin to which there was no sufficient outlet, the company cut a channel in the bed rock 15 feet deep and a mile and a half long, at a cost of $80,000, into which a tail sluice was put. The company charges 50 cents per day for the privilege of running a sluice-head into the drain, and the company have, besides, all the gold which they can catch in it, and it amounts to about $3,000 per year, leaving $2,000 net.

EUREKA DITCH, (EL DORADO COUNTY.)—The Eureka Canal Company owns two ditches, which were made as rivals to take water from the north fork of the

Cosumnes. They supply Pleasant Valley, Diamond Springs, El Dorado, Missouri Flat, Logtown, Buckeye Flat, Shingle Springs, Clarksville, Western Diggings, and the divide north of the Cosumnes to within 12 miles of Sacramento city. The main trunks of the two ditches are 170 miles long, and the trenches, which carry not less than 100 inches each, are 180 miles more; making 350 miles of ditching owned by the company and tended by its 17 employés. The length of small ditches made by the miners to carry the water from the company's lines to their claims is not less than 450 miles. The original cost of the two ditches and their branches was $700,000, and they are assessed at $30,000. There are 16 miles of flume belonging to the company, and there is one reservoir that covers 160 acres. Along the higher lines of ditch the charge for water is 16 cents per inch for 10 hours for mining, and on the lower lines from 10 to 12 cents; but farmers pay 33 cents, because the water is worked up and lost to the company, whereas the miners' water runs down into the lower ditches, and is sold from them again perhaps three or four times over. This company sells for an inch the amount of water that escapes through an orifice three inches high and an inch wide without pressure.

INDIAN DIGGINGS DITCHES.—Three ditches from the south and middle branches of the middle fork of the American river to supply Indian Diggings, Brownsville, Fairplay, Slug Gulch, and Cedarville, carrying 1,000 inches in all in the spring, and declining to 150 inches in September. One of these ditches was finished in 1853, and the other in 1854 and 1855. The three are owned now by one man. The original cost of the three was $125,000, and they are now assessed at $15,000. There is a mile and a half of flume. The charge is 12½ cents per inch for 12 hours, and 18¾ cents for 24 hours. The inch is delivered under six inches of pressure. There has been sale for all the water previous to 1867. The expenses of the ditches while full are about one-fourth of the receipts.

NATORNA DITCH.—The Natorna ditch takes its water from the south fork of the American river, 14 miles above Folsom, and supplies Red Banks, Mormon Island, Willow Springs, Rhodes Diggings, Texas Hill, Alder Creek, Rebel Hill, Prairie City, and Tates's Flat, which together contain about 500 miners. The ditch was constructed in 1852 and 1853, and the total cost of the main trunk and branches has been $200,000. The present assessed value is $75,000. The main trunk is 16 miles long, eight feet wide on top, five feet wide at the bottom, and three deep. There is also one mile of flume. The price of water varies at different places, but the average is 20 cents per inch per day, and the inch is delivered under six inches of pressure. The net annual profits since 1860 have been $30,800, and the gross receipts were twice as much. Previous to 1861 the gross receipts were about $75,000 annually.

In 1857 the company purchased 9,000 acres of land, most of it auriferous ground covered by their ditches. Having thus a large amount of land which it becomes important to improve, the company have undertaken to build up a large manufacturing town at Folsom, to which they are about to bring 250,000 inches of water, with a fall of 80 feet. A canal is being cut a mile and a half long, 40 feet wide at the top, 25 at the bottom, and seven feet deep, with a grade of four feet to the mile; and a dam is to be built in the American river, of granite laid in cement, 400 feet long, 60 feet wide, and 57 feet high. The whole work will be finished in 1868, and with its assistance Folsom will become the most important manufacturing town of the coast, next to San Francisco. Water power can be furnished here at one-third the cost of steam, and no other town on the State coast can have power so cheap or so much of it, or so near San Francisco.

SOUTH FORK DITCH.—The South Fork canal, in El Dorado county, has a main trunk 34 miles long, and carries 600 inches of water, which is taken from the south fork of the American river to supply Placerville and vicinity. The original cost was $500,000, and the present value is about one-tenth of that sum.

The total length of the main flume, laterals, and branches is 142¼ miles. The length of the ditch from the dam on the south fork of the American river to the reservoir near Placerville is 24 miles; from the reservoir to Coon Hollow, nine and three-fourth miles, and from Hangtown Creek to Buckeye Flat 32 miles. The Poverty Point branch is four and one-eighth miles long; the Indian Hill branch, four and a half; the Clay Hill branch, two; the Shober Hill branch, five; the Hangtown Hill branch, one and one-eighth; the Texas Hill branch, one and a half. The Gold Hill canal is 10 miles long; its branches and laterals, 12¼; the Weber canal, 13¼; the Iowa canal, 21, and the Red Hill branch, one and a half. The South Fork ditch has three reservoirs: the Silver lake, which holds 170,000,000 cubic feet; the Red lake, which holds 115,000,000; and the Willow valley, which holds 56,000,000 cubic feet. The Gold Hill ditch has very muddy water, and sells for an inch the water which runs through an orifice two inches high and an inch wide under a four-inch pressure. The South Fork canal sells for an inch the amount that escapes from a hole an inch square under six inches of pressure. The charge for water is 25 cents per inch for mining purposes at all seasons. Water for irrigation has been supplied in some cases for $7 per acre of vineyard in its second year, when the vines need water once or twice a week. The grade of the South Fork flume is four and a half feet to the mile. In one place iron pipe is used to carry 50 inches of water across a depression 1,600 feet long and 190 feet deep. The pipe has a diameter of 10 inches, and the head of the inverted siphon is 20 feet higher than the foot. The iron is about a sixteenth of an inch thick. The proprietor, Mr. T. B. Hunt, expresses the intention of constructing a ditch to supersede the present flume, to be 27 miles longer, to have a grade of 10 or 13 inches per mile, to carry not less than 5,000 inches of water, and to supply many places above the level of the present flume.

PILOT CREEK DITCH.—The Pilot Creek ditch takes its water from Pilot, Little Silver, and Rock creeks, and supplies Georgetown, Volcanoville, Bottle Hill, Fairplay, Kelsey, Johntown, Spanish Dry Diggings, Spanish Flat, Greenwood, Pilot Hill, and Wild Goose. The main ditch is 60 miles long, and cost $180,000, and there are 65 miles of branches which cost $320,000, making the total cost $500,000; and the present market value is $18,000. The ditch is considered one of the best in the State, on account of the small proportion of flume and the solidity of the banks, which are seldom broken. The largest piece of flume is 300 feet long and 95 feet high. The capacity of the ditch is 1,500 inches, but it is seldom full. It carries 1,000 inches about nine months of the year, and 300 inches at the close of the dry season for three months. The length of the main ditch terminating at Wild Goose flat is 60 miles; the Bottle Hill branch, 10 miles; the Volcanoville branch, 5 miles; the Kelsey's branch, 10 miles; the Fairplay branch, 7 miles; the Spanish Dry Diggings branch, three miles; the Rock creek feeder, 7 miles; the Rock Cañon feeder, three miles, and the El Dorado ditch 20 miles. The price for water is 12½ cents per inch.

MICHIGAN FLAT DITCH.—The Michigan Flat miners' ditch, on the north side of the south fork of the American river, was commenced in 1858 and completed in 1860, at a cost of $65,000. It is now assessed at $3,000, but since January, 1865, the expenses have been greater than the receipts by $3,019. From July, 1862, till January, 1865, the net profit was $13,673. Much of the flume was washed away last winter. The water is sold at 20 cents per inch for 12 hours to placer miners; at 20 cents per inch to quartz miners for 24 hours; and to farmers at $10 per acre for the season, on an average. The amount received in a year for irrigation water is $1,200.

COLOMA DITCHES.—Two companies supply Coloma on the south side of the south fork of the American river, with ditches which carry about 500 inches of water and are 13 miles long. They supply Coloma and Uniontown, charge the same rates as the Michigan Flat miners' ditch, and sell about one-third of their water for irrigation.

Bear River Ditch.—The Bear river and Auburn Water and Mining Company has 75 miles of main trunk and 250 miles of branches, constructed at a cost of $1,000,000, and now assessed at $25,000. In 1863 the receipts were $90,000; in 1864, $75,000; in 1865, $55,000; and in 1866, $40,000. The ditch takes its water from Bear river, and supplies Auburn, Illinoistown, New Castle, Pine Grove, Virginiatown, Clover Valley, Antelope Ravine, Secret Ravine, Miners' Ravine, Mississippi Bar, Rattlesnake Bar, Horseshoe Bar, Doten's Bar, Rose Flat, Millertown, Doty's Ravine, Doty's Flat, and Whiskey Diggings—in fact, the whole country between the American river and Bear river, extending 25 miles from north to south, and as many more from east to west. It is estimated that $50,000,000 have been washed out by means of the water of this ditch, and could not have been obtained without it. The Bear River ditch carries 3,000 inches when full, and the Gold Hill ditch 1,500; but in September the two do not carry more than 2,000 inches. The Bear River ditch had 13 miles of flume on the line when first made, but since then ditch has been substituted for all save half a mile. In one place there was a flume 139 feet high and 900 feet long, erected at a cost of $22,000, and ditch has been substituted for it. This company has been notable for its litigation, in which it has expended $250,000, and some of the judgments rendered against it have been notorious for their injustice.

Michigan Bluff Ditch.—The El Dorado Water Company obtains its water from El Dorado cañon, and supplies Michigan Bluff and vicinity. The main ditch is 20 miles long, and the total length of ditch and branches 35 miles. The amount of water carried is 400 inches during the rainy season, but the ditch is dry after the middle of July. The ditch was commenced in 1853 and finished in 1855, at a cost of $100,000. It is now assessed at $8,000. In the spring the demand for the water is not equal to the supply. The price is 15 cents per inch, delivered under a six-inch pressure.

Dutch Flat Ditch.—The Dutch Flat Ditch Water Company's ditch has a capacity of 3,000 inches, takes its water from the north fork of the American river and from Little Bear river, and supplies Dutch Flat, Gold Run, Nary Red, and Lost Camp, and formerly it supplied Blue Bluff. The length of the ditch and branches is 60 miles, the original cost $100,000, and the present assessed value $40,000. For three months 4,000 inches are sold per day; but for the last four months of the dry season the amount is not more than 400 inches. The water is sold under six inches of pressure, at 12½ cents per inch. The Central Pacific railroad runs for portion of its route very near the ditch, and has done very serious damage to it. The direct loss so far has been not less than $60,000. The railroad has become owner of the ditch itself, where it crosses the sections belonging to the road; but has not charged the water company anything for the privilege of using the land. But in consequence of the near proximity of the railroad cutting and embankment the ditch was ruined for about a mile and a half, and it was necessary to erect 3,000 feet of flume, and to lay down 3,500 feet of 31-inch iron pipe, and 837 feet of 32-inch pipe. The ditch began to supply water in 1851.

South Yuba Ditch.—The South Yuba Canal Company takes water from the South Yuba, Deer creek, Rock creek, Meadow lake, and other lakes in the neighborhood of Meadow lake, and supplies Nevada, Chalk Bluff, You Bet, Omega, Alpha, Blue Tent, Quaker Hill, Scotch Flat, and Grass Valley, in Nevada county, and Dutch Flat and Gold Run, in Placer county. The company owns several ditches, which measure in all 275 miles in length, and cost $1,000,000. Bean's History and Directory of Nevada County says: "In 12 years the expense account of the company reaches $1,130,000, and its receipts $1,400,000." A dam 42 feet high and 1,150 feet long was built across the outlet of Meadow lake, which when full is a mile and a quarter long and half a mile wide.

There is a tunnel 3,800 feet long, cut at a cost of $112,000 through a divide between the South Yuba and Deer creek. The company control about 12,000 inches.

The South Yuba ditch, in Placer county, is 26 miles long, beginning at the lower end of Bear valley, and supplying Gold Run, India Hill, Cañon creek, and Nary Red. The ditch was completed in 1865, and it runs 2,500 inches. There is usually demand for all the water. The assessed value is $20,000. The grade of the ditch is 13 feet to the mile. The largest flume is 48 feet high, and 100 feet long. The head of the ditch is so elevated that the water is sometimes full of snow, and is unfit for hydraulic washing or for any other kind of mining. The cost of the ditch was $108,000.

Truckee Ditch.—The Truckee ditch, to supply Minnesota and other points in the vicinity on the Blue lead, near the southern line of Sierra county, was constructed in 1858, and was abandoned and went to ruin in 1865. It is said the cost of the ditch was $1,000,000. As the diggings grew poor, the ditch ceased to pay for the expense of repairs. There were 13 miles of flume, eight feet wide and four feet deep, hung on the side of a steep cañon. An artificial lake was made for a reservoir. The capacity of the ditch was 3,000 inches.

Sears's Ditch.—Sears's Union Ditch is, with its branches, 18 miles long, and supplies Howland Flat, Pine Grove, Potosi, St. Louis, and Cedar Grove. It carries 2,000 inches for four months in the wet season, and about 200 inches in October. There are two miles of fluming. An extension of the ditches has been commenced, to be 20 miles long, and to cost $50,000. The charge is 30 cents per inch for 24 hours for piping companies, and 50 cents for drifting companies. The water is sold under a pressure of 10 inches, measured from the middle of the orifice. There is a demand for all the water, except in the spring. The extension is to supply Scales's Diggings and Poverty Hill. At the latter point the company is also cutting a bed rock tunnel six feet high, six feet wide, and 500 feet long to drain a basin nearly a mile square of rich ground. The tunnel is to be finished next year.

Nevada Reservoir Ditch.—The Nevada Reservoir Ditch Company takes 1,000 inches of water from Wolf creek, and supplies Sucker Flat and Mooney Flat. The main ditch is 28 miles long, and in that distance there are not more than 600 feet of flume, the highest 12 feet. The ditch was commenced in 1857, and finished in 1860, at a cost of $116,000. The company does not sell any water, but uses it all on Sucker Flat, in its own claims. There has been no washing at Mooney Flat for two years.

Excelsior Ditch.—The Excelsior Canal Company owns the Excelsior, the Bovyer, the Tunnel, and the Onsley Bar ditches. The first named takes 1,500 inches from the South Yuba. It was commenced in 1854, and finished in 1858. The supply is constant, and the length is 28 miles. The Bovyer is 20 miles long, and takes 2,000 inches from Deer creek, opposite Rough and Ready; but the supply fails in the summer. The work was commenced in 1858, and finished in 1859. The Tunnel ditch, commenced in 1851, and finished in 1852, is 20 miles long, and takes 1,000 inches from Deer creek. It fails in the summer. The Ousley Bar ditch is 10 miles long, and starts at Smartsville, where it is fed with 800 inches of fresh water from other ditches. It was commenced in 1852, and finished in 1853. On the Excelsior ditch there are five miles of low flume, and half a mile of 40-inch iron pipe, a mile of 20-inch pipe, and half a mile of 30-inch pipe. The 40-inch pipe crosses a depression 150 feet deep, and with a head of 32 feet, carries 2,500 inches of water. The original cost of the four ditches was $1,000,000. The water is discharged under 10 inches of pressure, measured from the centre of the orifice. The price is 20 cents per inch for less than 100 inches; 15 cents per inch for more, and for irrigation there is no fixed price; but a field of 10 or 15 acres pays $50 for a season. The amount of water is about 5,000 inches for eight months, 3,500 for two months, and 2,500 for the last two months before the rains come.

FORBESTOWN DITCH.—The South Feather Water Company gets water from the south fork of Feather river, and supplies Forbestown, Brownsville, Hansonville, Evansville, Wyandotte, Bangor, and Brown's valley, and, in fact, the entire divide between the South Feather and the North Yuba. The main ditch is 30 miles long, and the branches 30 miles more. The work was commenced in 1855, and finished in 1857. There is one mile of flume on the main ditch. The highest part is 60 feet high, but very little of that. The original cost of the ditch was $300,000, and its present assessed value is $25,000. The ordinary charge per inch for 24 hours is 30 cents, and for 12 hours 20 cents; but there are places where the water, after being sold, can be picked up and sold again, and there the price is 10 cents for 12 hours. It is probable that a branch will be constructed to Indiana Ranch and Oregon Hill, at which latter place there is a large body of rich ground.

OROVILLE DITCH.—The Oroville ditch has a main trunk 22 miles long, and was finished in 1856. The original cost was $250,000, and the present assessed value is $20,000. The capacity is 800 inches, and the supply exceeds the demand. The price is 50 cents per inch for drift claims, 10 cents for hydraulic and sluice claims, and $1 25 per acre per week for irrigation.

TABLE OF CANALS AND WATER DITCHES.—The following complete table of all the canals and water ditches for mining purposes in the State is taken from Langley's Pacific Coast Directory, a valuable work published biennially in San Francisco. As many of these properties have been consolidated or changed hands since the table was prepared, the names of the owners are omitted. Mr. Langley says:

> There are 5,328 miles of artificial water courses, for mining purposes, constructed in this State, at a cost of $15,575,400. In addition to the length here stated, there are numerous subsidiary branches, the aggregate length of which is estimated at over 800 miles, and several hundred miles of new ditches in the course of construction.
>
> In addition to those enumerated above, there are numerous enterprises organized to furnish water for municipal and agricultural purposes. Twenty-seven cities and towns in the interior are thus supplied, and the capital employed amounts to several millions of dollars. The Spring Valley Water Works, of San Francisco, is an extensive and costly undertaking, with a capital of $6,000,000. The county of Los Angeles has nearly 300 miles of ditches, and extensive works for the supply of water have been completed in San Bernardino, Yolo, and several other agricultural counties of the State.

Table of canals and water ditches for mining purposes in the State, with the location, source of water, length, cost, &c., of each.

Name of ditch.	Source of water.	Miles in length.	Cost.
AMADOR COUNTY.			
Amador	Sutter creek	13	$20,000
Amador Co. Canal	Mokelumne river, north fork	66	400,000
Boyle		¼	3,500
Buckeye	Sutter creek, north fork	5	3,000
Buena Vista	Sutter creek, north fork	15	18,000
Butte Canal	Mokelumne river, north fork	50	125,000
Cosumnes Water Co	Cosumnes river, south fork	22	40,000
Dry Creek	Dry creek	4	6,000
Indian Gulch	Jackson creek, middle fork	10	10,000
Indian Gulch	Rancheria creek	3	2,000
Kellum Ditches (3)	Jackson creek, middle fork	22	22,000
Lancha Plana	Jackson creek, middle fork	30	30,000
Lorees	Rancheria creek, south fork	5	2,000
Meeks	Jackson creek, south fork	2	1,500
Mile Gulch	Rancheria creek	4	2,000
Open Cut Flume	Sutter creek	1¼	90,000
Pardees	Jackson creek, south fork		
Purinton's	Sutter creek, middle fork	25	15,000

Table of canals and water ditches, &c.—Continued.

Name of ditch.	Source of water.	Miles in length.	Cost.
AMADOR COUNTY—Continued.			
Phelps & Co	Dry creek	6	$6,000
Pigeon Creek	Cosumnes river, south fork	7	8,000
Potosi	Dry creek	5	2,500
Proctor, Walker & Co.'s	Jackson creek	14	16,000
Reichling & Alt (2)	Sutter creek, south fork	8	10,000
Richtmyer	Dry creek	15	10,000
Rich & Co.'s	Big Bar cañon	5	4,000
Ritter	Cosumnes river	25	150,000
Sutter Creek and Volcano	Sutter creek	7	18,000
Volcano	Mokelumne river, tributaries	43	140,000
BUTTE COUNTY.			
Abbott & Co	....	1½	700
Butte Creek	Butte creek	10	10,000
Cherokee Co	Table mountain	10	5,000
Deweys	Feather river, west branch	11	20,000
Forbestown	South Feather river	......	....
Hutchings	....	2	1,000
Little Butte	Butte creek	14	8,000
Oregon Gulch	Oregon gulch	3	3,000
Rock Creek	Rock creek	3	1,200
Spring Valley	Spring valley	4	4,000
Table Mountain	Table mountain	4	6,000
Williams	....	2	2,000
CALAVERAS COUNTY.			
Calaveras County Ditch Co	Stanislaus river	36	150,000
Campo Seco & Mok. Hill Canal Co.	Mokelumne river	36	....
Clark & Co.'s	Mokelumne, south fork	25	80,000
Conrad's	Mokelumne, forks	8	20,000
Fisher's	Mokelumne, middle fork	15	15,000
Fisher's	Mokelumne, north fork	20	20,000
Harris	Mokelumne, middle fork	7	10,000
Kadish	Mokelumne, middle fork	12	11,000
Old Gulch	O'Niel's creek	10	15,000
Pillsbury's	Lincoln Fork, Mokelumne river	12	10,000
Pope	Willow creek	7	8,000
San Antonio	San Antonio creek	15	15,000
Table Mountain	San Antonio creek	28	40,000
Union	Murray creek	10	10,000
Union Water Co	Stanislaus, north fork	50	350,000
DEL NORTE COUNTY.			
Bunker Hill	Independence creek	4¼	18,000
Cox & Frazier	Myer's creek	2	1,000
Curley Jack	Grider creek	3	3,000
Grider's	Grider creek	2	1,500
Independence	Independence creek	1	4,000
Indian Flat	Myer's creek	3	3,500
Lone Pine	Indian creek	4	8,000
McLaughlin	Ruxton's creek	2	800
Moore's	Buzzard Hill creek	2	1,000
Patrick's	Buzzard Hill creek	2	2,000
Quartz Gulch	Quartz gulch	1½	400
Stevens W. M. & M. Co	Coon creek and Craig's creek	7	15,000
Wingate Bar	Oak Flat creek	1	2,000

Table of canals and water ditches, &c.—Continued.

Name of ditch.	Source of water.	Miles in length.	Cost.
EL DORADO COUNTY.			
Brownsville	Cosumnes river, south fork	8	$15,000
Cataract	Cosumnes river, south fork	6	10,000
Clay Hill	Hangtown creek	2	500
Eagle	Cosumnes river	8	500
El Dorado & Tunnel Hill	American river, south fork	10	15,000
Eureka Canal Co	Cosumnes river, north fork	450	500,000
Foster	Hangtown creek	2	1,200
Gold Hill	Hangtown creek	12	12,000
Granite Creek	American river, south fork	3	9,000
Iowa	Iowa and Brush cañons	21	20,000
Italian	Chunk cañon	3	3,000
Jones's Hill	Otter creek	15	10,000
Michigan Bar	Cosumnes river, middle fork	20	60,000
Montezuma	Hangtown creek	10	6,000
Parker	Webber creek	10	30,000
Pilot Creek	Pilot and Rock creek	150	300,000
Mull's (3)	Hangtown creek	13	4,000
Rock Creek & Michigan Flat	Am. river S. F., and Rock creek	......	150,000
Rossington	Webber creek and Chunk cañon	10	30,000
Roush & Simpus	Cañon creek	10	6,000
Shanghae	Cosumnes river, middle fork	16	12,000
Shober	Big cañon	5	5,000
South Fork Canal	American river, south fork	33¼	300,000
Texas	Hangtown creek	1½	300
Webber	Chunk cañon	13½	16,000
INYO COUNTY.			
San Carlos	Owen's river	15	30,000
KLAMATH COUNTY.			
Camp Creek	Camp creek	1	2,000
Cecilville	Salmon river, east fork	7½	7,500
Nordheimer Creek	Nordheimer's creek	2	2,600
Petersburg	Salmon river, south fork	5	7,000
Sawyer's Bar	Salmon river, north fork	3	5,000
Sundry other ditches	....	73	....
LASSEN COUNTY.			
Adams	Susan river	5	7,000
Adams & Batchelder	Susan river	4	5,000
Emerson	Willow creek	8	12,000
Susanville	Piute creek	1¼	2,000
MARIPOSA COUNTY.			
Mortons	Maxwell's creek	15	10,000
Snow Creek	Snow creek	10	800
MONO COUNTY.			
Mono	Virginia creek	20	75,000
NEVADA COUNTY.			
Buckman & Currans	Steep Hollow creek	13	20,000
E. Williams	do	16	40,000
Empire Co.'s	Shady creek	13	50,000

Table of canals and water ditches, &c.—Continued.

Name of ditch.	Source of water.	Miles in length.	Cost.
NEVADA COUNTY—Continued.			
Eureka Water Co	Middle and South Yuba rivers	150	....
Excelsior Canal Co	South Yuba and Deer creek	69	....
Gardner's	Bear river	22	$30,000
Nevada Water Co	Shady creek	13	40,000
Remington Hill	Steep Hollow creek	16	40,000
Sargent & Jacob's	Greenhorn creek	56	30,500
South Yuba Canal Co	South Yuba river	200	1,500,000
Stehr's	Greenhorn creek	4	4,500
Union	do	5	12,000
PLACER COUNTY.			
American River W. & M. Co	American river	22	100,000
Auburn & Bear River	Bear river	90	650,000
Bartlett & Thomas	do	220	65,000
Byrd's Valley	Volcano cañon	3	2,000
Dutch Flat Water Co	American river, north fork, and Little Bear river.	60	100,000
El Dorado Water Co	El Dorado cañon	31	100,000
Gold Hill and branches	Bear river	40	110,000
Grizzly	Shirt Tail cañon	6½	5,000
Hall & Hubbard's	Bear river	13	50,000
Hancock	Volcano cañon	10	15,000
Hills	Indian cañon	10	10,000
Independent	Volcano cañon	10	10,000
Indian	Indian cañon	10	10,000
Indiana Water Co	Cañon creek	10	10,000
Jamison	Indian cañon	2	4,000
McKee	Shirt Tail cañon	15	23,000
McKinstry	Owl creek	25	9,000
Miner's	Shirt Tail cañon, south fork	20	35,000
Mountain	Deep cañon	7	15,000
North Shirt Tail	Shirt Tail cañon	12	25,000
Secret Cañon	Secret cañon	16	100,000
South Yuba	South Yuba river	25	50,000
Todd's Valley	Volcano cañon	12	32,000
Union	Shirt Tail cañon	8	9,000
Union, Yankee Jim	do	12	128,000
Volcano	Volcano cañon	10	15,000
PLUMAS COUNTY.			
Burton Gulch	Burton gulch	4	5,000
Cascade Water Co	South Feather river	15	30,000
Feather River and Warren Hill	do	14	20,000
Grub Flat	Mead Valley creek	4	5,000
Humbug	Butte creek	4	6,000
Hungarian Hill	Slate creek	2	2,000
Indian Bar	Chipp's creek	3	3,000
Mosquito	Mosquito creek	3	4,000
Mount Pleasant	Silver lake	10	30,000
Nelson Point	Nelson creek	6	30,000
Pioneer	Feather river, south fork	10	10,000
Plumas	Silver lake	8	25,000
Richmond Hill	Onion Valley creek	4	12,000
Saw Mill & Taylor Hill	Mill creek	5	15,000
Spanish Ranch	Spanish creek	30	15,000
Spring Garden	Spring Garden creek	4	4,000
Twelve-Mile Bar	Rush creek	4	8,000
Do	do	2	1,500
Do	do	2	1,000
Do	do	2	2,550

Table of canals and water ditches, &c.—Continued.

Name of ditch.	Source of water.	Miles in length.	Cost.
SACRAMENTO COUNTY.			
American River W. & M. Co	American river	30	$300,000
Deer Creek W. & M. Co	Cosumnes river	6	133,000
Natoma W. & M. Co	American river	16	390,000
Sacramento & Amador Canal Co	Cosumnes river	6	125,000
SHASTA COUNTY.			
Arbuckle	Cottonwood, middle fork	12	10,000
Bald Hill	Cottonwood creek	8	15,000
Cedar Flat	Whiskey creek	3	3,000
Clear Creek	Clear creek	53	140,000
Cottonwood	Cottonwood creek	18	10,000
Davis	Clear creek	8	12,000
Do	do	2	10,000
Eagle	Eagle	16	10,000
Know Mucket	Clear creek	4	5,000
Prairie	Cottonwood, north fork	17	15,000
Quartz Hill	Churn creek	8	4,000
Sacramento	Sacramento creek	22	25,000
Spring Creek	Spring creek	10	16,000
Toson	Clear creek	3	4,000
Watson	Jerusalem	17	18,000
SIERRA COUNTY.			
American	Little Grizzly creek	7	50,000
Arnott	Fiddle creek	7	12,000
Council Hill	Rock creek	3	4,000
Cox Bar	Yuba river	1	2,500
Depot	Indian creek	1½	3,000
Feather River	Feather river, south branch	2	4,000
Fiddle Creek	Fiddle creek	2	1,500
Fisk	Goodyear's creek	4	18,000
Goodyear's Bar	Yuba river	2	5,000
Grass Flat	Grass flat	3	2,500
Green & Purdy	Little Grizzly cañon	4	13,000
Grizzly Hill	Cherokee creek	2	3,000
Hosier	Cannon creek	11	50,000
Humbug	Humbug cañon	3	2,000
Indian Hill	do	3	6,000
Irish	Yuba river	3	5,000
Jim Crow	Jim Crow cañon	8	12,000
Kanaka	Ladies' cañon	2	14,000
Kimball	Bunker Hill	6	40,000
Rock Creek	Rock creek	3	10,000
Said & Reese	Sardine lake	7	34,000
Sailor	Shower branch	6	10,000
Sayer's Union (4)	Slate creek and tributaries	15	150,000
Slate Creek & Gibsonville	Slate creek, west branch	3	10,000
Snow Creek	Snow creek	4	9,000
Truckee	Truckee lake	......	......
Waukegan	Slate creek, west branch	3	7,000
SISKIYOU COUNTY.			
Altona, Mugginsville	Kidder's creek	16	3,000
Altona, Oro Fino	do	15	4,000
Barker, Oro Fino	do	12	4,000
Barkhouse	Barkhouse	5	2,000
Brown	Kidder's creek	9	3,500

Table of canals and water ditches, &c.—Continued.

Name of ditch.	Source of water.	Miles in length.	Cost.
SISKIYOU COUNTY—Continued.			
Callahan's Ranch	Scott river, south fork	3	$300
Cottonwood	Cottonwood creek	......	10,500
Crawford's	do	8	8,000
French Flats	Scott river, south fork	4	800
Fort Goff	Turner creek	5	3,000
Hawkinsville	Greenhorn creek	6	4,000
Jackson's Bar	McKinney creek	3	2,500
McKinney's Creek	do	4	3,000
Mugginsville	Howard creek	5	2,800
Quartz Hill	Mill creek	4	2,500
Quartz Valley	Howard creek	7	2,500
Scott Bar	Mill creek	5	4,000
Scott River	Scott river	20	40,000
Shasta River Canal	Shasta river	85	300,000
Siad Valley	Klamath river	4	2,000
Whiting Hill	Lake Whiting	3	2,500
STANISLAUS COUNTY.			
Kappelmann Co	Six-mile bar	10	60,000
Knight's Ferry & Table Mt.	Stanislaus river	7	25,000
La Grange	Tuolumne river	7	40,000
Mountain Brow	Littlejohn's creek	4	5,000
San Joaquin	Stanislaus river	15	40,000
TRINITY COUNTY.			
Attingers	Indian creek	2	3,500
Canyon Creek	Guzner gulch	2	3,000
Canyon Creek W. Co.'s	Canyon creek	4	12,000
Carder's	Eastman gulch	1	1,500
Carrier Gulch	Carrier gulch	2	2,000
Chapman's	Soldier creek	2	4,000
Currie's	Franklin creek	2	4,000
Depinett's	Canyon creek, east fork	5	8,000
Dunham's	Mooney gulch	2	3,000
East Fork	East Fork	5	6,000
East Fork	East Fork of north fork	2	3,000
Eastman's	Eastman's gulch	3	6,000
Evans' Bar	Maxwell's creek	2	2,000
Fegan's	Clear gulch	3	4,000
Fenning's	Grizzly gulch	2	2,000
Gold Bluff	McKinley gulch	2	2,000
Hatchet Creek	Hatchet creek	3	5,000
Honest Bar	Trinity river, north fork	3	6,000
Junction City	Canyon creek	3	5,000
Junction City	Canyon creek	3	10,000
Lewistown	Deadwood creek	2	2,500
Mooney's Gulch	Mooney's gulch	2	3,500
North Fork	Trinity river, north fork	2	2,000
North Fork	Logan creek	2	2,000
Ohio Flat	Grass Valley creek	2	2,000
Pettijohn & Co. (3)	Mooney and Calvin gulches	5	5,000
Poverty Flat	East Weaver	1½	1,500
Red Flat	Gwin gulch	1	1,000
Red Hill	Conner's creek	2	6,000
Red Hill	Rush creek	1½	1,500
Ridgeville	Stuart's Fork, east fork	8	10,000
Rush Creek	Rush creek	5	8,000
Steiner's Flat	Brown's creek	8	10,000
Stratton's	Indian creek	2	2,000
Swift Creek	Swift creek	3	4,000
Taylor Flat	French creek	8	10,000

Table of canals and water ditches, &c.—Continued.

Name of ditch.	Source of water.	Miles in length.	Cost.
TRINITY COUNTY—Continued.			
Trinity Centre	Swift creek	2	$2,000
Turner Bar Co.'s	Redding's creek	4	6,000
Wares (3)	East & West Weaver creeks	11	12,000
Weaver Creek	Weaver creek	2	2,000
Weaver Creek	Weaver creek	4	6,000
Weaverville Basin	Weaver creek	8	10,000
TULARE COUNTY.			
Broder & Van Gordan	Kawiah	5	1,000
Brown's Mill	Packwood creek	3	4,000
Campbell & Martins	Tule river	4	1,500
Davenport's	Sand creek	2	1,500
Everton's	Kawiah	2	3,000
Fisher's	Sand creek	3	800
Jenning's	Mill creek	4	1,000
Johnson's	Deep creek	7	1,500
Long Ditch	Kawiah	3	800
Lowry, Worthley & Co	Sand creek	2	700
Owen's	Sand creek	4	1,000
People's	Kawiah	10	8,000
Reservation	Tule river	4	2,000
Rice's	Kawiah	5	2,000
Town Ditch	Brown's Mill ditch	4	2,000
Townsend's	Sand creek	1½	500
Union Vineyard & Farming Co	Kawiah	7	1,500
TUOLUMNE COUNTY.			
Big Oak Flat	Tuolumne river	40	600,000
Hydraulic Co	Tuolumne river, north fork	50	300,000
Jamestown & Chinese Camp	Wood creek	7	15,000
Phœnix Water Co	Tuolumne river, north fork	100	300,000
Sonora and Yorktown D. Co	Tuolumne river, north fork	10	....
Tuolumne County Water Co	Stanislaus river, south fork	35	550,000
YUBA COUNTY			
Birmingham	Strawberry creek	......	1,500
Brown's	Oregon creek	......	500
Burnett's	Dry creek	......	10,000
Camptonville	......	......	3,000
Collyer	Dry creek	......	600
Deaver's	Oregon gulch	......	900
Dennison's	......	......	500
Dunn's	Sleighville gulch	......	1,500
Excelsior Canal Co	Deer creek	150	500,000
Feather River	Feather river	......	10,000
Little Willow	Willow creek	......	1,200
McQueen's	Dry creek	......	8,000
Monroe & Cornell	New York ravine	......	12,000
Mrock's	Dry creek	......	600
Mullan's	Dry creek	......	1,000
Never's	Iudian creek	......	2,000
New York	Oregon creek	......	600
Nine Horse	New York ravine	......	500
Oregon Creek	Oregon creek	......	6,000
Peacock	Yuba river	......	1,000
Pine Hill	Bear river	......	1,600
Sleighville	Sleighville gulch	......	2,000
......	Dry creek	......	3,000
......	Oregon creek	......	10,000
Spencer	Indian creek	......	6,000
Turffrey's	Dry creek	......	8,000

SECTION XI.

THE MISCELLANEOUS MINERALS OF THE PACIFIC COAST.

In referring to the nature, extent, and development of the miscellaneous minerals found on the Pacific coast, exclusive of gold, silver, and quicksilver, the materials are so abundant, and the details so interesting, as to render it difficult to select such portions as will convey the desired information within the limits prescribed. When it is remembered that there is scarcely a metal or mineral used in the arts, or known to science, but is represented on this coast—generally in greater proportion than in any other country—it will be perceived that a mere list of their names, and of the localities in which they are found, would occupy more space than would be desirable in an official document. This branch of the report is, therefore, confined to a few facts relating to the best known and most important of these products. The details, though necessarily incomplete, contain sufficient data upon which to base an opinion of the extent and variety of the miscellaneous mineral resources of the Pacific slope.

COPPER.—This branch of mining, which was in process of development last year, is at present in a depressed condition. Various circumstances, briefly referred to hereafter, have caused a reduction in the value of metallic copper in the markets of the world. The depression has been felt more severely by the miners on this coast than by those of any other part of the Union, because copper mining being in its infancy here, was struggling to secure the aid of capital for its extension; an object the attainment of which is hopeless under existing circumstances. Another drawback has been the increased cost of freight, consequent on the demand for vessels to carry wheat, flour, and other produce to the ports to which it has been usual heretofore to ship ores and metals. This increase has been equal to a reduction of $5 per ton in the value of the ores; because they must be shipped in order to reach smelters and consumers, as there are no regular purchasers here, except such as buy for export.

Reference to some of the causes which have thus crippled the development of this source of wealth affords the best means for judging whether such reduction is likely to be permanent, or of merely temporary duration. India, for the past quarter of a century, has absorbed all the ingot copper sent there from all parts of the world. Many of the wealthy natives in the distant interior of that country hoarded these ingots as treasure, and they passed as currency among them. The importations of gold and silver since the discovery of these metals in California and Australia, together with the extension of railroads and other features of European civilization in Asia, have almost entirely abolished this custom. The precious metals have superseded copper in the business of its semi-barbarous people. This change has not only caused a stoppage in the demand for copper in what was formerly the best market for its disposal, but thousands of tons, the accumulations of years, have been brought out from hiding places to be exchanged for the precious metals. It will require years to absorb the present supply of copper in India by the manufacturers of that country, particularly as most of the utensils and ornaments made of that metal used by the people are imported from Europe or the United States.

The increasing supply of ores from Australia, Cuba, Chili, Africa, Europe, and the United States, before the revulsion in India was severely felt, had already begun to exceed the demand; and, of course, this excess has greatly increased since, giving the control of every open market to those countries where it can be mined and melted at the lowest cost.

The increase in the number of vessels built of iron in Europe, and the decline in ship-building in the United States, have curtailed the demand for sheathing, which a few years since was the chief use to which copper was applied in this country.

Another cause for the decrease in the demand for copper arises from the substitution of cheaper metals in the manufacture of articles formerly made of copper, and the introduction of processes for depositing copper on other metals by electricity, by which a mere film of the dearer metal gives the cheaper one the appearance, and causes it to serve most of the purposes of the other.

The above are among the leading causes of the present depression in the value of copper, and springing, as they do, from circumstances not likely to change for the better, the prospects of the copper mines on this coast are not very flattering.

The mines of Bolivia and Chili, owned by European capitalists, worked at less cost, and more convenient to the English and French markets than those of California, can drive the ores from this coast out of those markets. The imports of South American ores into England in 1866 reached 35,336 tons, while but 4,591 tons were received from California, and the disproportion will be still greater during the present year. During the past six months only 1,211 tons have been shipped from San Francisco to England, while the receipts from South America during the same period exceeded 482,000 quintals of 96 pounds each. The present prices of freight and ores forbid any increase of shipments hence during this year. South America, in 1866, also sent 86,440 tons of ore to France, a market to which our ores cannot be sent with profit, unless a great reduction can be effected in the expenses of mining and exportation.

The copper mines of the United States have formidable competitors in the European markets in the mines of Africa and Cuba. The richest ores on the English market for some time past have been brought from the Cape of Good Hope, Africa. These ores average from 30 to 50 per cent. The mines of Cuba have also yielded a large quantity of rich ores. The product of fine copper in Europe and America, during 1867, is estimated at 90,000 tons, of which Bolivia and Chili will produce two-thirds.

The following tables, showing the value of ores in England during the past three years, and the cost of their production on this coast, explain the causes why California cannot compete with Chili in supplying the European markets. As the prices at Swansea, Wales, regulate the whole European market, it is only necessary to give the rates at that place.

Price of copper ores at Swansea in 1865, 1866, *and* 1867.

Grade.		1865.	1866.	1867.
10 per cent	per ton.	$41 50	$33 87	$36 50
17 per cent	do...	66 62	58 75	66 50
21 per cent	do...	91 62	67 62	69 75

Cost of extracting and delivering ores at Swansea.

Mining	per ton.	$14 00
Bags	do...	4 00
Sorting	do...	1 00
Wear and tear of machinery	do...	1 50
Interest on capital	do...	1 50
Freight to San Francisco	do...	10 00
Freight to Swansea	do...	15 00
Commissions, &c	do...	5 00
Insurance	do...	1 50
Cartage, wharfage, &c	do...	50
Total expenses	do...	54 00

By comparing these expenses with the list of prices above, it will readily be perceived that ores under 15 per cent. do not cover expenses. As seven-eighths of the ores obtained on this coast do not reach that standard, it is unprofitable to extract them. The same figures apply to the markets at New York and Boston. As more than three-fourths of the ores smelted in Europe and the Atlantic States do not average 15 per cent., it is clear that the mines whence such ore is obtained possess a great advantage over those on the Pacific coast, entirely through the saving in cost of labor and transportation.

The statistics relating to the copper mines of England, published by authority of the government of that country in 1866, show that during that year 198,298 tons of ore were obtained from the English mines, which yielded 11,888 tons of fine copper, or an average of but 5.9 per cent. This ore, estimated at $25 per ton, was valued at $4,967,450. As the mines on this coast could be made to produce annually an equal quantity of ore of greater value, the proportions of the loss the country sustains by their remaining undeveloped deserves consideration.

The establishment of comprehensive smelting works at some suitable place, with ample capital to conduct operations on a liberal scale, would be a great advantage to the country by encouraging the development of this interest, and would doubtless in time yield fair returns for the amount invested.

The present plan of erecting temporary smelting works near each mine, for the purpose of operating on the richest ores, is an injury to the copper interest, because it exhausts materials which might be more advantageously employed. These temporary works can only operate on the richest oxides, carbonates, and silicates, which form but a small proportion of the ores. The great mass of them consists of sulphurets, in the reduction of which the oxygen, carbon, and silica of the richer ores serve an important purpose. It is the opportunity of selecting suitable ores for combining, which the smelters of Wales possess, with a market for every kind and grade offered, that enables them to operate so successfully. The ores from the Cornish mines are sulphides, and would be too poor to work, but for this arrangement. Lime and silica being essential elements in the reduction of copper from its ores, common sense teaches that it is more economical to employ these elements when combined by nature with the metal, than to collect them from other sources and mix them artificially, at additional cost. It was to secure this advantage that the Boston smelters, during the past year, sent to Wales to purchase a cargo of carbonates to mix the sulphides received from this coast, because the miners here, who have large quantities of carbonates, prefer converting them into matte.

None of the English copper miners ever smelt their ores. They are all sent to the public market; smelting and mining being considered separate and distinct operations in that country.

The method of transacting business in the Welsh ore market is peculiar, but gives satisfaction, owing to its fairness to buyer and seller. All the ores intended for sale are piled and sampled ten days before the sale takes place. During that time the smelters desiring to do so can take samples to estimate the value of such parcels as they want. Each sends in his bid in writing, sealed, directed to the agent having the particular parcel for sale. The highest bidder for any lot has it awarded to him. This is a better plan than for miners to be obliged to seek purchasers, without knowing the value of the ore in the market.

New Discoveries.—The circumstances above stated have had the effect of preventing prospecting for copper to a great extent. But some discoveries have been made within the present year, though few of them have been much developed. Among the most important are the following:

The Sierra Buttes copper mine, located near Hurd's ranch, Sierra county. The lode on this discovery, which may be traced by its outcrop for nearly a mile, differs from that in any of the copper mines, in several material respects. It is the only body of copper ores of any importance thus far found in the granite on this coast, except at Meadow lake, Nevada county, hereafter referred to.

The ore is contained in a quartzose gangue rock, the lode having a well-defined *fluccan* (as the miners term the soft clay which usually accompanies true veins of ore) on the foot wall; the hanging wall being a hard, compact, feldspathic granite, which also constitutes the "country" in which the lode is enclosed. There are considerable quantites of molybdenum in the vein-stone, in the form of both the sulphite and oxide of that metal. There are other lodes of copper ores in the same locality contained in the granite; but each differs somewhat in composition and appearance from all the others, forming an interesting field for scientific investigation. The Sierra Buttes is the only one of these lodes that has been worked to any extent, owing to its containing sufficient gold in the gangue rock to pay for extraction, though the ore will average 10 per cent. of copper. The cost of transportation from that distance to a market over such roads as exist, under the present condition of affairs, causes such a grade of ores to be valueless. A tunnel is in course of construction on this mine, which when completed will strike the lode at a depth of 1,000 feet below the surface. In a shaft sunk on it to the depth of 60 feet, the lode was found to be seven feet wide.

A promising outcrop of copper ore has been found near Marango Pass, San Bernardino county, California.

A company was incorporated at San Francisco in July, 1867, with a capital stock of $240,000, for the purpose of working a copper mine in the Moro district, San Luis Obispo county, California.

In the California mine, at Meadow lake, Nevada county, the highest inhabited portion of the Sierra Nevada, at an altitude of 8,000 feet above the level of the sea, metallic copper is found in the quartz, the gold and copper in which, though intimately mixed, are never alloyed with each other.

The vein-stone of the lodes in this elevated district carries a percentage of copper, generally in the form of sulphurets, combined with those of iron, lead, zinc, cobalt, nickel, and arsenic. In the Shooting Star mine, at the depth of 40 feet, the lode contains an ore which yields 15 per cent. of copper, $40 per ton of silver, and $20 per ton of gold. It is proposed to erect furnaces to smelt the rich but complex ores of this district.

The Lyons Company's mine, located about three miles from the town of Ashton, Colusa county, in the Coast range, contains a body of oxides and carbonates. A temporary furnace was erected to work these ores, but being unfit for the purpose, one of Haskell's water-lined furnaces is now being built. This, though not a new discovery, had not been of much importance till smelting operations were commenced.

Persons who have visited the new Territory of Alaska report it as being rich in copper. M. Foucoult, a French gentleman, who spent several months in the Territory among the Indians, states that they value copper as much as civilized men value gold. The chiefs wear masses of it suspended round their necks, as highly prized ornaments. Some of the higher chiefs have lumps of the metal that weigh several hundred pounds each, which are heir-looms of the tribe, and are kept in the great wigwam. This gentleman states, that in order to obtain these nuggets of copper, the Indians keep up large fires for weeks on the outcroppings of the lodes, which melts the carbonates and oxides near the surface. It is a well-known fact, mentioned in the writings of the earlier visitors to this coast, that the natives of that Territory, and those immediately adjoining, were the only tribes that possessed copper weapons and ornaments when first discovered.

In August, 1866, a discovery of copper ore was made in the mountains, on the south branch of King's river, Tulare county, about 68 miles from Fresno City. There are four distinct and parallel lodes, a few feet apart from each other, in the locality, each containing a percentage of "horseflesh" ore, or erubescite, in a quartzose gangue rock. The lodes are from two to eight feet wide, and are traceable for several miles, cresting a high hill and across a steep canon. An analysis of the ore shows it to contain 60 per cent. copper, $20 per ton in gold, and nearly $60 per ton in silver. Owing to the mountainous character of the country where this discovery was made, but little can be done towards its development till a road can be made to convey materials. This will involve an expense, which capitalists are not disposed to incur in prospecting copper mines at present. If there were no copper in the ledges, there would be less difficulty in obtaining funds to prospect them for the gold and silver they contain; but the disasters which have befallen the copper interest within the past year have cast a feeling of distrust over everything bearing the name or nature of copper. There is abundance of wood and water in the vicinity of the discovery; and could one of Haskell's furnaces be erected there, the parties who own the lodes would probably realize something for their labor and enterprise.

Several discoveries have been made within the past few months in the mountains bordering the Tule river, in Tulare county, which have been prospected sufficiently to demonstrate their value. The lodes are generally similar in character to those found on the south fork of King's river, in the same county, and described above. The localities of the two discoveries are about 50 miles apart. The lodes on the Tulare are contained in the metamorphic slate, near its junction with the granite.

A body of ore has been partially developed near Copper City, Shasta county, on which a company of English capitalists have offered to erect smelting works, provided the parties owning the mine will grant them a lease on terms they propose.

It is stated by parties who have been prospecting in Utah during the past season that the croppings of copper ore are abundant in the south and southeast sections of that Territory. Copper ores are reported to have been found in the Battle Mountain district, Humboldt county, Nevada, about 90 miles north-northwest from Austin.

The surveyors employed by the Central Pacific Railroad Company report the existence of copper-bearing lodes in the Trinity mountains, Humboldt county, Nevada.

Recent Development of the Copper Mines.—The condition of affairs, resulting from the causes stated, will be best exhibited by showing the extent of the development of the mines described in the previous report. This will also afford a means for comparison.

The Copperopolis Mines.—These mines, owing to their extent, the capital expended in their development, the value of the ores extracted from them, and the quantity at present available for extraction, place them at the head of the copper mines on the Pacific coast.

The Union mine has been but partially worked during 1867. Its owners find it more profitable to place it in a condition for future operations, than to extract ore for sale at present prices. But little ore has consequently been taken out—only such as it was necessary to move in making explorations. The number of men employed has been reduced to 150; in 1865 and 1866 nearly 400 were employed. The chief work doing at the mine at present is keeping it free from water and making the necessary repairs to the works above and below ground.

The explorations in the main shaft have extended to 500 feet in perpendicular depth, where the lode on the north, near the line of the Keystone ground, is 15 feet wide. At the 400-feet level in the same shaft, 100 feet above, the lode has decreased to six feet in width. This increase in its proportions is a favorable symptom of permanence, and proves the correctness of the opinion that the contraction of the lode at the 400-feet level would not be permanent. The total quantity of ore taken from this mine from January 1 till July 15, 1867, was 8,382,855 pounds; total quantity since it was opened in 1861, 108,731,678 pounds; all of which has been exported to the Atlantic States and Europe, except about 2,376,000 pounds, or 1,000 tons, portions of which remain at the mine, at Stockton, and San Francisco, ready for shipment.

THE KEYSTONE MINE.—Explorations in this mine have been extensive and costly during the past year. The cross-cut toward the south line, in the sixth level, at a depth of 350 feet, running from the south or Houghton shaft, struck the main lode where it was 10 feet wide, of 15 per cent. ore. It was deemed best to sink the main shaft 200 feet, to avoid the necessity of working by a winze at so great a distance from the shaft, as it was calculated the shaft would strike the lode at that depth. At the depth of 552 feet a cross-cut was made 43 feet in length before the lode was reached. Its width at that depth could not be ascertained, owing to the great increase of water, which prevented the men drifting till a sufficiently large sump-hole could be made.

The company have taken out but little ore during the past year, having ceased operations, except for exploration, early in April. At present they only employ a few men to attend the machinery and pumps, to keep the mine from filling with water. The total receipts from the sale of ores taken from this mine amount to $375,000. The amount of assessments collected exceed $100,000, the whole of which has been expended in developing the mine and purchasing machinery. The company has never declared a dividend.

THE OTHER COPPEROPOLIS MINES.—The Empire, Consolidated, and Inimitable were worked to some extent in the spring; but have been idle for several months. The owners of the latter mine (which is parallel and immediately adjoining the Union) had sued that company for taking out ore from their ground. The case attracted considerable attention from its novelty and the value of the interests involved. It was decided in favor of the Union Company.

THE NAPOLEON MINE.—The new shaft on this mine was sunk to the depth of 195 feet, when work was suspended. No ore has been taken from it during 1867.

THE CAMPO SECO MINE.—This mine has been partially worked for a few months during the present year. Smelting works were erected by the company as early as November, 1865, and arrangements made for working economically. A railroad a mile in length was constructed for the purpose of conveying the ores from the mine to the furnace. By a judicious arrangement in the location of the works, the ore, after reaching the surface through the shaft, is carried down to the furnaces by its own weight, and these being located on the banks of the Mokelumne river, the slag and other waste is dumped into that river at trifling cost for labor.

The smelting works consist of two cupola furnaces and a McKenzie blast, moved by a water wheel, and a roasting kiln. The furnaces are built of sandstone and lined with steatite, both of which materials are abundant in the neighborhood of the works, and appear to be tolerably well adapted for the purpose. The object of the company in erecting these works was not to make copper or matte of a high standard, but to concentrate the ores obtained below 10 per cent. into about 35 per cent. regulus. The experience of the persons in charge confirms the remarks heretofore made in relation to the impolicy of each mine smelting its own ores. The ores here, like the bulk of all obtained from the mines on the cupriferous belt which traverses the State from north to south, are nearly pure sulphides of iron and copper, rarely containing more than five per cent of silica, and consequently difficult to reduce alone. The average assay of 20 samples shows 45 per cent. sulphur, 40 per cent. iron, 6 to 10 per cent. copper, the remainder being silica, water, &c. To reduce such an ore to regulus it was found necessary to add 20 per cent. of quartz, in order to supply sufficient silica to combine with the iron after the liberation of that metal from the sulphur. Had silicates of copper or ores containing a considerable percentage of quartzose gangue rock been available, a much larger product of copper would have been obtained at the same cost of fuel, flux, and labor.

Even in the processes for roasting the ores in kilns the absence of silica is a great disadvantage and source of loss. The sulphur, when in such excess, as in this class of ores, when heated, coats the ores, forming a refractory material for future operations.

The two furnaces on this mine, when in full operation, smelted about eight tons of ore and 20 per cent. of quartz in 24 hours. To do this it required 250 bushels of charcoal daily, which cost about 20 cents per bushel; two men to attend the furnace as smelters, two to supply materials, two to carry off the slag, which, owing to the large proportion of iron and the nature of the flux, was large, and two others to prepare the materials for the furnace feeders. Most of the work was performed by Chinese labor.

THE LANCHA PLANA MINES.—These mines being under the control of the proprietors of the Union, have not been worked during the year.

THE MINES IN AMADOR COUNTY.—The Newton, Cosumnes, and Pioneer mines, in this county, ceased operations in April, 1867.

THE MINES IN MARIPOSA COUNTY.—The principal mine in this county, La Victorie, owing as much to disagreements among its stockholders as to the depreciation in the value of ores, has been idle nearly the whole of the present year.

Having given a description of this mine in previous report, the following particulars relating to its working will be interesting for reference: After an examination made by order of the company, the engineer in his report states that the mine from the tunnel has been well opened. The foot-wall, where the tunnel enters the vein, is well defined; but, as yet, the hanging wall had not been found, although the vein had been pierced about 70 feet. Two thousand tons of ore had been taken out of the mine, chiefly from pockets or smaller veins, mixed with the materials which had been thrown into the larger vein. A series of deposits of ore exists above the foot-wall, more or less connected, containing quantities of black oxide, and until the works are carried below the surface disturbances the size, value, or permanency of the lode cannot be determined. From the indications in the present workings there is reason to believe the mine will prove permanent and valuable. The company not having the means to obtain proper machinery, had done the best they could under the circumstances. The mine is well timbered, and is in good condition for future operations.

A shaft had been sunk about 90 feet, on an incline which it was supposed would intersect the lode. But by a cross-cut run from the bottom it was found that the lode had changed in dip. The shaft was therefore sunk nearly vertical, so as to strike it about 80 feet below, or on a level with the tunnel. While running this cross-cut, seams and deposits of black oxide were met with.

The extraction of ores while the mine was worked was slow and costly, owing to the broken nature of the country rock. The difficulties that beset the company are in part due to the isolated locality of the mine. It is too far from any travelled road to obtain the advantage of cheap transportation by teams returning empty from the mountains. The nearest point of shipment is 84 miles, over a rough country. The cost of transportation swallowed up the value of the ore. In addition to this, the company conducted its business on the same extravagant scale as the richest of the Washoe companies. Its officers, salaries, office rent in San Francisco, and incidental expenses outside the mine amounted to $16,000 per annum. There are few undeveloped mines that could stand such a drain. Under more economical management, and with cheaper transportation, this mine might add something to the wealth of the State, even at the present low price of copper. Its ores are abundant, and of a higher grade than the average.

THE BUCHANAN MINE is located in Hunter's valley, Mariposa county, and has been worked at intervals during the past year. The shaft, in June, had reached 150 feet in depth, where the lode was found to be seven feet wide, of tolerably compact sulphurets. Having oxides, silicates, and carbonates convenient to the smelting works, this company, during the year, has made 100 tons of

60 per cent. matte, most of which has been forwarded to San Francisco, where it remains at present for want of a market. There can be no better illustration of the reduction in the value of copper than is afforded by the working of this mine. The matte made from its ores in 1865, averaging 60 per cent. of copper, sold at San Francisco for 16 cents per pound. The same grade of matte cannot be sold at present at nine cents per pound.

At James's ranch the Green Mountain Company have erected smelting works and made a few tons of matte.

None of the other copper mines in this county have been worked during the present year.

THE MINES IN SAN LUIS OBISPO COUNTY.—But little having been done towards developing the mines in this county during the present year, there are no new facts to report concerning them.

THE MINES IN LOS ANGELES COUNTY.—With the exception of prospecting among the claims near the Solidad pass, nothing has been done in this county during the past year.

THE MINES IN PLUMAS COUNTY.—The Genesee Valley smelting works had to cease operations during the winter owing to the weather, and work has not been resumed since, the price of copper offering no inducements to the proprietors to incur the expense of refitting furnaces and mine.

THE MINES IN DEL NORTE COUNTY.—With the exception of the Alta none of the copper mines in this county have been worked this year. The Alta company have been engaged in developing their mine. They have sunk their main shaft to the depth of 500 feet, run their tunnel 200 feet, and drifted at several levels, finding bodies of ore which appear to improve in quality as the workings progress. The disturbed and broken character of the formation ceases at 200 feet from the surface. The company has sent 400 tons of ore to San Francisco since January, 1867, which has been reshipped to New York. The average of ore has been about 16 per cent.; but the costs attending its transportation to San Francisco, and reshipment thence to New York, absorbs the value in expenses.

THE MINES IN CONTRA COSTA COUNTY.—None of the copper mines in this county have been worked this year.

THE MINES IN NEVADA COUNTY.—Capital and labor have been expended in prospecting the copper mines in the western part of this county, where there is a copper-bearing formation extending across it from north to south, on which many claims have been located and to some extent explored. The lodes are generally large, but the ores are of too low a grade to cover the costs of transportation. Of several hundred tons sent to New York and Swansea the average returns did not exceed nine per cent. of metal. Under more favorable conditions, with cheap labor and transportation, these mines might be made to pay. At present they can only be worked at a loss.

The first shaft in the district, called the Well, because sunk for the purpose of obtaining a supply of water, is near Spenceville, in Rough and Ready township. It was used as a well for five years, till the excitement about copper in 1862, when, on cleaning it out, a deposit of sulphurets was exposed 70 feet wide, and extending to an indefinite length in the direction of the stratification of the enclosing metamorphosed clay slate, with a foot-wall and fluccan. But the ore, only ranging from eight to nine per cent., did not pay for extraction and transport.

The Last Chance, the only mine worked for copper in this county, is located on this belt, near the Empire ranch. It was discovered in 1863, and has since been explored with such satisfactory results as to warrant its owners, who are among the most enterprising citizens in the State, (D. O. Mills, of San Francisco, A. Delano, S. D. Bosworth, and E. W. Roberts, of Grass Valley,) to make application to procure title from the federal government to the land on which the mine is located, the first application of the kind made. A shaft has been sunk to the depth of 200 feet, where the lode is found 12 feet wide, of sulphurets, averaging from 12 to 20 per cent. of metal. Before the rise in price of freight a shipment of this ore to Swansea returned a profit of $35 per ton. The company own 2,400 feet on this lode.

Considerable excitement was created in this county towards the close of 1866 by the discovery of ores in the Fox mine, from which about 40 tons of oxides and carbonates were shipped to Swansea in October of that year. But the excitement ceased as the price of copper declined, though nearly 100 claims were recorded during the last quarter of 1866.

Several small parcels of ores have been received at San Francisco during the present year from the Western Star and Green mines, located near the Last Chance and on the same lode; but at present and for several months past none of the mines have been worked.

OTHER CALIFORNIA COPPER MINES.—With the exception of the Union Company, who own a mine in Marin county which they prospected for a few months in the spring, the above is a full statement of the progress made in copper mining in California during the year 1867.

THE OREGON COPPER MINES.—The Queen of Bronze and other mines in this State have been idle during the past year. New discoveries have been made, but none of them have been developed sufficiently to prove their value. They are referred to merely to show the extent of country on this coast in which copper has been discovered.

The most important of the discoveries have been made in the southern part of Douglas county, where croppings of ore exist, not in the form of gossan, as in California, but as masses of oxides and carbonates, which will be of importance if extensive smelting works should be erected.

The mines on Eagle creek, Baker county, have been explored with such results as to have induced the owners to enter into a contract with the Oregon Steam Navigation Company to carry their ores to San Francisco, at a stipulated price, for a year.

THE LOWER CALIFORNIA COPPER MINES.—The Sanee mine, at Loretto, has not been worked during the past year. The shaft on this mine has reached the depth of 114 feet, where the lode is seven feet wide, the ore said to average 12 per cent.

A few tons of ore were received occasionally at San Francisco from mines along the lower coast, during the past spring, but such shipments have entirely ceased for several months.

THE COPPER MINES OF NEVADA.*—Most of the ores found in the district of Pahranagat, though generally famous for the silver they contain, are more properly described as copper ores. They consist chiefly of gray copper, copper pyrites, erubescite, and other familiar ores of copper, combined with sulphites of silver, lead, iron, zinc, &c. No gold has yet been found in the district. These ores are contained in a quartzose veinstone in some ledges; in others the gangue rock is calcspar, (a carbonate of lime.) Some of the ores contain as high as 50 per cent. of copper. This district lies in the extreme southeast corner of Nevada, where it joins Utah and Arizona, in 37° 37′ north latitude and 112° longitude west from Greenwich. The mineral wealth of the district is contained in a range of mountains about six miles long and four miles wide, running nearly north and south, the general name for which is Mount Irish, though each peak has a separate name. Some of the crests of the range tower to the height of 11,000 feet, and are covered with perpetual snow. The lodes present the characteristics of true fissure veins, and appear to consist of several series, crossing each other in some places at right angles, the whole being contained in a metamorphosed limestone formation. In any other locality they would be valuable for copper mining.

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* Described more fully in the section on Nevada.

Similar ores are obtained in the mines of Inyo and Mono counties, California. These, however, contain a per cent. of gold. These ores are refractory when worked by the ordinary mill processes. Some of this class of ore taken from the Camanche mine, in Mono county, and sent to Swansea for reduction, returned $1,000 per ton in gold, silver, and copper. The mines in Kearsarge, Fish Springs, Aurora, and other districts among the higher divisions of the Sierra Nevada produce similar ores. The completion of the Central Pacific railroad will be of great benefit to the miners of this extensive mineral region, particularly if a process shall be discovered by which the gold and silver can be extracted without wasting the copper they contain—a contingency quite possible. If such an establishment for smelting as the interests of the coast demand were erected at some point convenient to water and railroad carriage, the refractory ores of the Sierras would become valuable.

The Peavine Mines.—In November, 1866, several tons of ores from this district were brought to Sacramento by the Central Pacific railroad, which passes within three miles of it, being the first shipment from the Sierras by railroad. The total cost for freight by railroad and steamboat was $12 per ton.

Two of Haskell's water-lined furnaces have since been erected in the district, one to operate for silver, the other for copper, but neither has yet been completed. The ores are chiefly carbonates and silicates, and the furnaces will probably be able to reduce them to a portable form for transportation. As they contain a per centum of gold and silver it may be found profitable to ship them to Europe for separation, till suitable works shall be erected here.

An excellent map of this district has been published by A. J. Hatch, deputy United States surveyor, which will be found useful for reference.

The Mines in Arizona.—The copper mines on Williams fork of the Colorado have been partially worked this year. The developments have been satisfactory so far as the extent of the lodes and the grade of the ores are concerned, but the difficulties attending smelting operations for want of furnace materials and fuel, the scarcity of means for transport, the high cost of freights from the mines to market, and the low prices paid for ores have caused a cessation of work or confined operations to a limited scale. In March there were 100 men employed at the Central and Planet mines, and about 150 about the works at Aubrey City, nearly all of whom have since been discharged.

The receipts of ores from these mines since January 1, 1867, have amounted to 1,156 tons, 600 of which were from the Planet mine. The whole quantity ranged between 20 and 60 per cent. of metal.

The ores in this district would be valuable if suitable smelting works were erected anywhere on this coast, as they are chiefly carbonates, silicates, and oxides.

The Great Central Mine contains 3,600 feet on two parallel lodes, and several hundred feet on other lodes adjacent. The ore is abundant and of good grade, and contains some gold and silver. In May last, the company had about 200 tons, averaging 25 per cent., and 50 tons of selected, averaging 60 per cent., lying on the river bank awaiting transportation. One of the smaller lodes, the "Marion," at the depth of 75 feet from the surface, is five feet wide, composed of oxides of iron and copper. At the depth of 125 feet from the surface the main lode exhibits symptoms of sulphur. This, while affording evidence of the permanence of the lode, is not favorable to smelting operations. For 200 feet on each side of the shaft on the main lode (which is the extent of its exploration) it is found to be from five to seven feet wide.

In April last the company completed a furnace capable of reducing 16 tons of ore in 24 hours, and made about 50 tons of coarse copper, ranging from 60 to 70 per cent., which has been sent to New York. But operations ceased in June.

The Planet Mine, though located near the Great Central, contains several lodes and deposits of ore separate from those worked by that company, and yields ores of a different character. In one of the drifts a body of red, ferruginous, calcareous cement was found, about 18 inches thick, but otherwise of unknown extent, which contains a per cent. of metallic copper in the form of fine spangles and flakes, beautifully crystallized, imparting a peculiar brilliancy to each fracture as the lights of the miners are reflected upon the grains. It differs entirely from other copper ores found on the coast. There are no traces of sulphur.

At the depth of 80 feet, in the main shaft, the lode is composed of a coarse Malachite, or carbonate of copper, nearly eight feet wide, quite compact, and pencilled with dark shadings like green marble. Along the foot wall there are masses of chrysocolla, or silicate of copper—much of it possessing great beauty—appearing like bright green jasper, elegantly marbled with darker green and blue pencillings. Some of these masses, which are susceptible of a high and permanent polish, would be valuable for ornamental purposes.

It is estimated that $100,000 worth of ores have been sold from this mine since 1862.

Mineral Hill Mine.—This and the Empire Flat mine are owned by Greenman & Martin, of San Francisco, a firm long engaged in the purchase of copper ores on this coast. They have erected two furnaces and other works, with a 30 horse-power steam engine to run the necessary machinery, at Aubrey City, a town which has sprung up on the banks of the river since the opening of the mines, having expended nearly $100,000 in opening the mines, building a wharf, making roads, &c.

The Springfield Company own the Punta del Cobre mine, and several lodes near the Great Central Company's mine, and there are other mines of probable value in the district.

It is to be regretted that these mines, after having been brought to their present stage of development at so great an expense, have been compelled to cease operations. Only a few hands are now employed to keep the property in order. The furnaces are idle.

The following details of the expenses of transportation from the Aubrey mines may be useful in showing that some of the causes which prevent their development may be removed.

The expenses in bringing ores from the mines to San Francisco sum up about $25 per ton; this, coupled with $15 per ton freight to Liverpool or New York, makes $40 per ton, without calculating insurance, commission, interest on capital, or costs for mining, which swell the actual cost of the ore to $70 per ton, nearly equal to the present market value of 25 per cent. ore. No further explanation is necessary to show why it is unprofitable to ship even rich ores from this district.

The difficulties in the way of smelting are as discouraging as those attending the exportation of the ores. No suitable materials so far as known can be had in the Territory of which to construct the furnaces. All material has to be brought from California at a great expense; steatite from El Dorado county and sandstone from Catalina island, &c. Owing to the depredations of the Indians the wood-cutters were unable to go out of sight of the settlement to obtain wood for charcoal, the supply of which was consequently deficient, the quality bad, and the expense enormous; charcoal made of iron wood, musquete, and cottonwood costs $50 per ton. The total product of copper made under these circumstances did not exceed 40 tons.

Under more favorable conditions the mines might be made profitable. There are places along the river banks where 100,000 tons of carbonates and oxides of copper, averaging 18 per cent. of that metal, could be quarried like marble; but such ores are valueless at present.

The following table gives the exports of copper regulus and ores from San Francisco since 1862:

Exports of copper and ores since 1862.

Year.	To New York.		To Boston.		To England.		Total.	
	Ores.	Copper regulus	Ores.	Copper regulus.	Ores.	Copper regulus.	Ores.	Copper regulus.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1862	86	....	3,574 16-20	....	....	....	3,660 16-20	....
1863	1,337	....	4,208 15-16	....	7 15-20	....	5,553 10-20	....
1864	4,905 16-20	....	5,064	....	264 7-20	....	10,234 3-20	....
1865	4,146 3-20	25	9,050	....	2,501 16-20	....	17,787 19-20	25
1866	9,962 8-20	422	4,536 13-20	....	12,384 15-20	80 10-20	26,883 16-20	502 10-20
1867	2,633	178	....	....	1,878	141 18-20	4,511	319 18-20
Total	23,070 7-20	625	26,434 4-20	....	17,126 13-20	222 8-20	68,631 4-20	847 8-20

The above table exhibits the decline in the exports during the present year. A considerable portion of that which has been shipped has not paid expenses, but was sent under contracts previously made.

Copper-Smelting Works erected on the Pacific Coast.—The following list of copper-smelting works erected on the Pacific coast, though not complete, shows the extent of the business and the amount of capital invested in its development:

List of copper-smelting works erected on the Pacific coast.

Where located.	Mine.	County.	State.	Plan.	Cost.
Antioch	....	Contra Costa	California	Welsh	$25,000
Copperopolis	Union	Calaveras	do	German	75,000
Waldo	Queen Bronze	Josephine	Oregon	do	40,000
Genesee Valley	Cosmopolitan	Plumas	California	Local	30,000
James's Ranch	....	Mariposa	do	Haskell's	20,000
Bear Valley	La Victoria	do	do	do	20,000
Near Placerville	....	El Dorado	do	do	10,000
Hunter's Valley	Buchanan	Mariposa	do	do	20,000
Near Ashton	Lyon's	Colusa	do	do	6,000
Peavine Hill	Peavine	Storey	Nevada	do	10,000
		*Josephine	Oregon	German	20,000
Williams Fork	Several	....	Arizona	Welsh	100,000
Campo Seco	Campo Seco	Calaveras	California	do	30,000
Total	....	....	....	....	406,000

* Completed June, 1867.

Several concentrating and roasting works have also been erected near some of the copper mines at considerable expense. The concentrating works on the Keystone mine, at Copperopolis, cost $50,000. It is quite fair to calculate that $500,000 have been expended in the construction of smelting and concentrating works on this coast during the past four years, nearly all of which has proved a loss for the reasons stated.

Importation of Metallic Copper.—The increase in ship-building on this coast, and the facilities for repairing large vessels by the construction of docks, &c., at San Francisco, create a demand for sheathing-metal and nails. The general use of copper plates in the quartz mills requires a large supply of this metal, as much of it is destroyed by the chemicals used in the processes for amalgamating the precious metals. The increase in the manufacture of machinery, in the construction of which brass forms a considerable item, and of articles wholly composed of copper or brass, a branch of business which gives employment to several factories and foundries, requires a constantly increasing supply of this metal.

The following statement, showing the imports of copper during 1866 and for the first six months of 1867, embraces only the rough metal and sheets. All other forms in which it is imported are included under the head of general merchandise. Though very incomplete, and confined to the imports received at San Francisco, this table shows that there is a field for the manufacture of copper on the Pacific coast which deserves the consideration of capitalists.

Imports of copper at San Francisco from January 1, 1866, to July 1, 1867.

Bars and packages: In 1866, 1,245; in 1867, 242; total, 1,487. Cases of sheathing: In 1866, 1,203; in 1867, 386; total, 1,589. The weight and value of the packages are not returned at the custom-house.

THE MANUFACTURE OF SULPHATE OF COPPER IN CALIFORNIA.—The annual consumption of the sulphate of copper on the Pacific coast amounts to nearly 500 tons. The present wholesale price is $200 per ton. About four-fifths of total quantity imported is used in the processes of amalgamation. The greater part of the other fifth, or about 100 tons, is used by farmers for soaking wheat, &c.; sulphate of copper, or blue-stone, as it is generally called, being the best known preventive of rust in that grain. Till recently all the sulphate of copper used here was imported, chiefly from England. At present there is sufficient made in San Francisco to supply the demand. Crane & Brigham, a firm in the drug business, have been engaged for several years in perfecting a plan for the manufacture of this article from the sulphurets, which were too poor to pay for export or concentration. They expended nearly $50,000 in apparatus and experiments, and obtained a patent for a process which they discovered in 1864. But the costs of labor and strong opposition from importers made it an unprofitable investment. In the spring of 1867, a method was discovered by them of making this article from the carbonates and oxides brought from the Williams fork of the Colorado, Arizona, by which it is prepared in the greatest purity at a cost below that for which it can be profitably imported. The San Francisco Refinery Works, and other establishments in that business, of which there are several, also make quantities of the sulphate of copper as a by-product of their chemical operations. Under these circumstances it is not improbable that the importation of this article will soon cease.

IRON.—The failure, till recently, to discover a deposit of coal on this coast suitable for smelting purposes, has prevented much attention being paid to the bodies of iron ores which are scattered throughout California and Oregon. But the discovery of good coal in Washington Territory, and in the late Russian possessions on this coast, within the past year or two, has brought the subject of iron smelting into notice. The consumption of pig, bar, plate, and every other description of iron, already considerable, must increase with the progress of the States and Territories on this side of the Rocky mountains, and the importance of this metal in manufactures and arts imparts to the subject an interest scarcely second to that attached to the production of the precious metals.

With an abundance of material necessary for the manufacture of iron at their doors, as it were, it is scarcely probable the people of this coast will be much longer content to import so essential an element of prosperity from foreign countries.

THE FIRST IRON-SMELTING WORKS ON THE PACIFIC.—Oregon is entitled to the credit of having erected the first iron-smelting works on the Pacific coast, though several of the heaviest stockholders in the enterprise are citizens of California.

The Oregon Iron Works are located at Oswego, about nine miles south of Portland, on the west bank of the Willamette river. They are the property of an incorporated company, having a capital of $500,000. The operations of this company were commenced in September, 1865. In 1866 the erection of the furnace and necessary buildings was commenced, and completed in June, 1867. But smelting was not immediately commenced, in consequence of an insufficient quantity of charcoal, the fuel intended to be used. The destruction of the company's foundry and machine shop by fire on the night of July 2, which involved a loss of nearly $100,000, further delayed operations.

The furnaces were erected under the direction of Mr. G. D. Wilbur, of Connecticut, and are constructed on the same plan as those in general use in that State. They are built of the basaltic rock which underlies the ore. This material is found to be adapted to the purpose. The cupola is 32 feet high, and the bosher or hearth nine feet six inches in diameter. The blast (hot) is applied through three tuyeres, under a pressure of two pounds to the square inch, generated by suitable machinery driven by water power.

The charcoal used is prepared from the Oregon fir, which has been found by experiment to be adapted to smelting purposes, and is very compact, weighing about 16 pounds to the bushel. Contractors supply it to the company at eight cents per bushel, delivered at the works. It is calculated the furnace will reduce nine tons of ore daily, (24 hours,) each two and one-half tons of which being estimated to produce one ton of metal in pigs.

The first pigs cast at these works, and consequently on the Pacific coast, were made on the 24th August, 1867, when about six tons of very good metal were run out. The ore used ranged from 60 to 65 per cent. The furnace has been running continuously since, producing from six to eight tons of metal per day. About 80 men are employed about the works as miners, furnace men, teamsters, &c.

On the 1st day of October the Oregon Iron Company had produced 224 tons of pig iron, 2,240 pounds to the ton, at an expense as follows:

For each ton (2,240 pounds) iron produced there were used—

166 bushels charcoal, costing at furnace 8 cents	$13 28
884 pounds lime, costing at furnace 40 cents	3 53
4,970 pounds ore, costing at furnace $2 50 per ton	5 50
Labor reducing each ton	6 67
Total cost of the pig on bank of river	28 98

This does not include interest on capital, or State and county taxes.

A sample of this metal was received at San Francisco August 30, 1867, which, after thorough tests by the various foundries in that city, was pronounced a superior article.

The average cost of importing pig iron from Europe to San Francisco is about $40 per ton, ranging from $35 to $45; the fluctuation arising from the rates of freight, which is usually from $12 50 to $15 per ton. Occasionally it is brought by French and German vessels at a lower price, as these vessels generally carry cargoes of light merchandise, which require heavy freight as ballast. The usual freight from Atlantic ports is from $12 to $16 per ton in currency.

Within the past year small parcels of pig iron have been received from Australia. The Australian iron costs about $40 per ton in gold, delivered on the wharf.

The following particulars concerning the cost of producing iron, copied from the report of the United States Revenue Commissioners for 1865 and 1866, will be found of interest in this connection. It will be seen by these figures that while it is quite possible to make iron on the Pacific coast as cheaply as in any other portion of the United States, it cannot be made as cheaply as in England:

An establishment capable of producing in the United States 10,000 tons of finished iron per annum would cost for ore, leases, lands, blast furnaces, mills, houses, and appurtenances necessary for the full equipment, from the ore to the finished iron, at the present time	$1,250,000
Capital to carry it on	750,000
Total	2,000,000
A similar one in Great Britain would cost	$500,000
Capital to carry it on	300,000
Total	800,000
Interest on $2,000,000 capital invested in American establishment at 8 per cent	$160,000
On 800,000 in England at 5 per cent	40,000
Leaving a balance of interest against American manufactures of	120,000

In the United States a fair average cost of producing pig iron is not less than $35 per ton. In England or Wales the cost of producing a ton of pig iron averages $14. To the difference shown by the figures given, it is just to add the difference per ton caused by larger interest on the greater capital invested in the United States. (*Vide* report, pages 327 and 328.)

This question of interest on capital is felt more severely on the Pacific coast than in any other State in the Union, and forms an impediment to all manufactures.

In the vicinity of the Oswego works are numerous beds of hydrous sesquioxide, which, according to estimates based on careful measurement, contain 50,000 tons. This ore by analysis is found to contain from 46 to 56 per cent. metal. Nearly one-fourth of these beds consists of solid masses of ore, the remainder consisting of the same deposit very much disintegrated and broken, but equally rich in metal.

At the distance of two and one-half miles from the works a similar body of ore has been found, which measures 100 acres superficially, and of a thickness varying from six to 12 feet. This body of ore is estimated to contain several millions of tons. Similar bodies of ore have been found at several places within an area of twenty miles of the works, extending as far, as St. Helen's, on the Columbia river. In every case where these deposits of ore have been examined they are found to be underlaid by volcanic lava and ashes, beneath which are heavy beds of basaltic rocks. No vein or deposit of the ore has been found in this basalt, but in many places the crevices and fissures in that formation are filled with scales and fragments of the overlying ore.

These bodies of ore present all the appearances of having been deposited in a liquid state, in indentations that existed at the time of the surface of the basalt. The whole formation has subsequently been tilted up so as to dip to the east at an angle of about 10 degrees. The present surface of the ore beds is covered with a deposit of sand, gravel, and clay, from a few inches to 10 feet in depth.

Similar bodies of ore exist in the vicinity of Mount Vesuvius, Italy, which are known to have been ejected from that volcano in the form of chloride of iron and subsequently metamorphosed to its present form.

Limonite is never found except in recent or secondary geological formations. It is the most valuable of all the ores of iron, being readily convertible into steel. The difference between limonite and hematite consists in the former containing from 15 to 20 per cent. of its weight of water, while the latter contains none. Limonite, owing to this difference, melts at a considerably lower temperature than hematite, a most important matter in a country where fuel is expensive.

An analysis of this Oregon limonite, made by Kellogg, Hueston & Co., of San Francisco, gave the following results:

Sesqui-oxide of iron	77.66
Moisture	11.16
Silica	1.08
Sulphur and phosphorus	.10
	100.00

Its specific gravity is 4.25. By actual working, on the large scale, it yielded 54.37 per cent. of metal in pigs.

The extraction of the ore involves but little expense, as it is all near the surface. It is estimated that it can be taken out and delivered at the furnace at $1 50 per ton.

These Oregon iron works labor under a disadvantage in having no limestone in their vicinity. This mineral is as essential in smelting operations as fuel itself. All the limestone used has to be brought from San Juan island, and costs $6 per ton delivered. As it requires one-third as much of this mineral as of the ore for smelting, this disadvantage is serious in point of expense.

IRON IN CALIFORNIA.—Every description of iron ores is known to exist in California in abundance. The most important bodies of them are found among the foot-hills of the Sierra Nevada mountains, at too great a distance from the manufacturing centres to admit of smelting with profit, to compete with imported iron at places along the coast having the advantage of cheaper supplies from abroad. The heavy cost of inland transportation from these central marts is an advantage, however, in supplying a local demand, because transportation upwards to the mountains is always dearer than it is downwards to the plains. The cost of castings received in the mountains from San Francisco rarely falls below $200 per ton; it is generally much higher. The consumption of cast iron among the quartz, lumber, grist, and other mills located among the foot hills reaches nearly 2,000 tons annually, and the demand is limited by the difficulty in supplying it.

The cost of erecting smelting works on a scale sufficiently large to supply the local demand need not exceed a few thousand dollars. The profits of such an establishment located among the mines, or on the line of a railroad connected with the mining districts, if properly conducted, would be remunerative. It is strange that, with such facts patent to capitalists, works of this kind have not been established at points where materials and facilities are known to exist for carrying them on to advantage.

The following particulars concerning bodies of iron ores found in this State, which have been examined by competent persons, will be useful in showing the character, importance, and location of these deposits. For convenience they are divided under the heads of specular, hematite, magnetic, chromic, titanic, and mixed ores.

SPECULAR IRON ORE.—Deposits of this ore have been discovered a few miles north of the town of Santa Cruz, 75 miles from San Francisco, near the sea, in the Coast range. There is abundance of wood and limestone in the vicinity.

Also on Utt's ranch, six miles from Auburn, Placer county, in the foot hills, 45 miles from Sacramento.

In the Coast range, in San Bernardino county, about 600 miles from Sacramento, is another deposit of this ore.

Also at Four Hills, a locality about 10 miles northeast from Downieville, Sierra county, among the summits of the Sierra Nevada. The ore at this place is very pure and abundant, in a densely timbered country, with limestone close at hand.

Plumas county, also, contains valuable bodies of this ore. On the side of a broad cañon in the southern portion of this county, in sight of the high peaks of the Sierra Nevada, about 16 miles from Downieville, Sierra county, within a couple of miles of the line of the proposed Oroville railroad, there is an iron mountain composed in great part of this ore. It assays from 40 to 70 per cent. metal. Parties have pre-empted 320 acres of the land embracing the mountain for the purpose of working it as an iron mine. It is intended to erect smelting works on the ground during the present fall. Wood, water, and limestone are close at hand, and the Beckwith Pass wagon road runs within a mile of the claim.

There are deposits at other places, but the above are among the most accessible.

Specular iron ore is somewhat similar in composition to red hematite, but is readily distinguished from that ore by breaking with a bright metallic fracture, almost like cast iron, to which peculiarity it owes its name. Like hematite, it is of volcanic origin. The ores of Pilot Knob and Iron Mountain, Missouri, belong to this class. It requires a much greater heat to smelt specular iron ores than any others of that metal; this trait is important on this coast. The iron made from this ore is the best known, when properly made.

MAGNETIC IRON ORES.—The most important, because the most convenient, body of this ore in California exists on the line of the Central Pacific railroad, near Clipper Gap, where there is a mountain of considerable proportions composed almost wholly of the variety known in Germany as "spiegelien," from which steel is made with so much facility in that country by the Bessemer process.

The advantages of having a plenty of wood, water, building materials, and fire-clay for furnace purposes, and limestone for flux, and a railroad running close by, have induced an attempt to erect smelting works in the vicinity. Robinson, Brown & Co.'s iron mines are located here, about three miles from the railroad and three miles from Bear river. These mines were located and patents for the land from the federal government applied for in May, 1866. The company purchased the title of the railroad to the even sections of the land, to the extent of about 1,500 acres. The greater portion of this land is well covered with timber suitable for charcoal. The ore crops out from the mountain in many places. There are two qualities in the deposit; on the east side it is highly magnetic, while on the west it is very much like the Oregon limonite. Assays made by Kellogg & Hueston, of San Francisco, in March, 1866, gave the following results: the magnetic ore, 64.37 per cent. metal; the hematite, 44.67 per cent. metal. A specimen sent to Professor Jackson, of Boston, Massachusetts, was analyzed by that gentleman, who states in the report on the subject that it contains no phosphorus, sulphur, titanium, or other substance injurious to the manufacture of iron.

A tunnel has been cut in the side of the mountain to test the thickness of the stratum. At the time of our visit, in June, 1867, it had been run for 30 feet, with no signs of the end. On the opposite side, where there were no croppings near the surface, a shaft was sunk 15 feet; at that depth they struck good ore.

Estimates as to the probable expenses of making pig iron at this locality and delivering it at San Francisco show that charcoal can be made and delivered at the furnace for 12½ cents per bushel, (the Oregon works pay 8 cents;) the lime will cost $2 per ton; the total cost for labor, materials, and interest on capital reaching $20 per ton, to which must be added $6 per ton for transport to San Francisco by railroad and steamer. The average cost of pig iron in that city during the past three years has been $41 50, landed on the wharf. Its price at present is from $47 to $50 per ton. The mines are 40 miles distant from Sacramento by railroad.

Arrangements have been made with the firm of Coffee, Risdon & Co. to erect one of Haskell's patent water-lined cupola furnaces, to test the working qualities of the ore. This furnace was to have been completed in August.

The parties interested in the enterprise, being men of limited capital, are not prepared to conduct operations on a scale to insure success. It would be to the benefit of the State if capitalists would take hold of the business.

Bodies of ore of a similar character exist near Gold lake, Sierra county, in the vicinity of the line of the Central Pacific railroad.

A deposit of fine magnetic iron ore was discovered in the summer of 1867 on Grouse ridge, 14 miles from Washington, Nevada county. This ore is energetically magnetic—so much so as to lift knives or nails—and is said to contain sufficient gold to pay for extracting that metal from it.

In the summer of 1867 a body of magnetic iron was discovered near Chapparal Hill, Butte county, near the Grizzly, a tributary of the Butte creek, about 46 miles from Oroville, on the Susanville road. The ore is found in a locality where the slate and granite formations unite. Some portions of it are so magnetic that fragments broken off can be lifted by the larger pieces. It was this peculiarity that led to its discovery. An analysis made by Kellogg, Hueston & Co., of San Francisco, yielded 65 per cent. of metal. The deposit is in the form of a stratum or bed of unknown thickness and extent. In July a shaft had been cut to the depth of 20 feet without passing through it. It had been traced 300 feet in length by nearly a quarter of a mile in width. Being located on a densely timbered hill, covered with broken slate, it was not convenient to trace it to its full extent. There is abundance of wood, water, and limestone in the vicinity.

Bodies of similar ores are found in the Santa Iñez valley, in the San Rafael district, Santa Barbara county, about 450 miles from Sacramento.

Magnetic iron ore or magnetite is one of the most extensively distributed and valuable of that metal found on this coast. It contains a larger per centum of metal than any of the other ores; when pure it generally contains from 60 to 70 per cent. It is changed in many places into specular ore by the addition of oxygen, which it absorbs from the atmosphere.

HEMATITE ORES OF IRON.—There are large bodies of simonite, identical in composition with the ores found at Oswego, Oregon, on the banks of Spring creek, a few miles west of Shasta City—at an elevation of nearly 6,000 feet above the sea—among the granite peaks of the Sierra Nevada, about 180 miles from Sacramento.

A deposit of red hematite was discovered in March last on the ranch belonging to the Sisters of Charity, about 16 miles from the city of Los Angeles. The ore presents itself on the surface for nearly a mile in a stratum averaging 15 feet thick, enclosed in hard metamorphosed clay slate.

CHROMIC IRON ORES.—This class of ores, so rare and valuable in the Atlantic States, is abundant on this coast, being found in the Coast range, the foot hills, and among the Sierra Nevadas, wherever there is serpentine in the country. Among the most important deposits of it are the scattered and broken masses which cover the ground for miles in the vicinity of the New Idria Quicksilver mine, in Santa Clara county. There is another body of it cresting the ridge which forms the boundary line between Monterey and Fresno counties. In Tuolumne county, near the Crimea House, are deposits which are found between the strata of talcose slate, lying in a vertical position, the weathered portions of which stand out from the surrounding hills like tombstones in a graveyard.

In Del Norte county to the north of the copper mines on the "Low Divide," there is a peculiar deposit of chromic iron disseminated through the serpentine, which constitutes the greater portion of the country thereabouts. This ore weathers into round grains like shot, from the size of a pin-head to a four-pounder, and is appropriately called iron-shot by the miners in the vicinity, who find abundance of it in the sluices when washing up.

There is another body of chromic iron in Del Norte county, of different appearance, on Smith's river, about 20 miles from Crescent City. This ore is compact, and as black as jet.

In San Bernardino county there are extensive deposits of this ore along the coast, some of which contain fine specimens of vauquelinite chromate of lead and copper.

On the south side of San Diego gulch, Calaveras county, on the crest of the highest hill, opposite the Noble Copper mine, there is an isolated mass of this ore that will weigh thousands of tons, which surmounts a rather singular formation. A tunnel run in the hill beneath, in search of copper, cut through several wide strata of serpentine, brucite, talc, and other magnesian minerals. Chromic iron, or chromate of iron, is of considerable importance in the arts, but not as a source for obtaining the metal. Though abundant on this coast, it is very rare in the Atlantic States and Europe. England contains scarcely any; that country imports about 5,000 tons annually, for the purpose of manufacturing the various compounds of chromium, used in calico printing, painting porcelain, making pigments, chromic acid, &c. A large quantity was formerly shipped to England from the Barehills, near Baltimore, Maryland, where the most valuable deposit on the Atlantic side exsits. With cheap transportation and labor this ore would pay to export.

Titanic Iron Ore is generally found on this coast in the form of fine grains, forming the greater portion of the "black sand," so difficult to separate from the fine gold obtained from the alluvial washings. All volcanic rocks contain titanic iron in the form of grains. As these rocks disintegrate the grains are set free. There are several varieties of titaniferous iron in the grains, most of which are magnetic. It has been found in a number of thin seams in trap, in El Dorado county, near Diamond Springs.

Some excitement was created in San Francisco, about a year since, by the discovery of titanic iron in the sand on the beach within the harbor. Small quantities of it were collected, and some of it smelted, under the impression that it would make pig-iron, and that there was a "lead" of it in the vicinity. The above explanation of its source shows how unreasonable such conclusions were.

Mixed Ores of Iron.—There is a body of iron ore on Pratt's Hill, near Ione, Amador county, on the border of the Sacramento valley, which does not belong to any of the varieties above described. It is of an earthy nature, and evidently of sedimentary origin, forming a stratum nearly 20 feet thick, extending for a mile near the top of a lode bluff, which projects into the valley. It contains a large per centum of iron. In several localities along the margin of the San Joaquin and Sacramento valleys there are deposits of iron ores in the form of ochres. It is not necessary to give details, as there are such abundant sources for obtaining better ores; they will be described under the head of "clays," &c.

Iron Ores in Nevada.—The surveyors employed by the Central Pacific Railroad Company report the discovery of extensive beds of magnetic iron ore within a short distance of the line of that road, near Crystal Springs. Also at Neilsburg, within a mile of the road, and at Long Valley. There are many other districts in Nevada which contain iron ore. There is a series of regular veins of specular ore, from 8 to 20 feet thick, near the east fork of Walker's river, in Esmeralda county.

Iron Ores in Utah.—This Territory abounds in iron ores. There are several deposits of carbonate of iron within 20 miles of Salt Lake City.

Iron Ores in Arizona.—The abundance of nearly all kinds of iron ores in this Territory is quite remarkable. Whole ranges of mountains along the Colorado are in great part composed of them. The copper mines at Williams fork are surrounded with beds of iron ores. In the Mineral Hill and Planet mines the ores are pure oxides of iron and copper. Several of the tunnels run in working those mines have been cut through solid beds of iron ore. The wall rock enclosing nearly all the copper lodes are of the same mineral.

CONCLUDING REMARKS ON ORES.—The above examples, selected from a great number of a similar character, are sufficient to show the abundance of the ores of iron on the Pacific coast, particularly in California, and the advantage that State possesses in having furnace materials and limestone convenient to the mines.

It will be observed by reference to the analyses that the "lay," or per centum of metal in the ores found on this coast, ranges from 46 to 80, or an average of upwards of 50. This, however, is applicable only to the higher grades. According to the government returns, published in England, the ores obtained from the mines in Wales do not exceed 33 per cent., and those from the mines in Staffordshire, the great iron district of England, do not exceed 30 per cent. Most of the ores found in that country require roasting as a preliminary process, owing to their containing deleterious elements. The ores on this coast, being nearly all oxide, can be smelted at one operation, and will produce a very pure metal.

THE CONSUMPTION OF IRON IN CALIFORNIA.—The consumption of iron in this State is large, and constantly increasing. The imports of crude metal, given in the accompanying table, constitute but a portion of the total quantity used, as much of it is obtained by remelting worn-out or useless machinery, and other articles, of which there are many thousands of tons in the State.

San Francisco is the centre of this trade. In addition to supplying California, as the following table will show, iron and machinery are exported to Nevada, and the adjoining Territories, the Sandwich Islands, Mexico, British Columbia, and other countries.

The following list of foundries and machine shops in San Francisco will convey an idea of the proportions of this business there. There are also 23 other foundries in California, and six in Nevada. The establishments at Sacramento, Nevada City, Marysville, Stockton, Sonora, and one or two others, are able to make almost any description of machinery.

IRON FOUNDRIES IN SAN FRANCISCO.—The *Vulcan* covers the block embraced by 137 feet on Frémont street, and running 275 feet to Beal street, and extending thence to Mission street. On this block there are brick and frame buildings, suitable for an extensive business. Every description of machinery, from a coffee-roaster to a locomotive, including boilers, and everything complete, is made here. Many improvements in the manufacture of engines and boilers have been introduced in this establishment. Most of the machinery used at the Mission woollen mills was made here, as was also the machinery for the mints at Mexico and British Columbia. The most powerful engines in use on the Comstock lode, Nevada, were also made here. A few months since a quartz mill was made here and shipped to Nicaragua, and a pumping engine for use on a mine at Parquiqua, Bolivia. The capacity of the furnaces at this foundry is sufficient to melt 35 tons of metal. Nearly 100 men are employed on the premises.

The *Fulton* is located on First street, and employs about 50 moulders, doing an extensive business in architectural casting; machinery of all kinds is also made.

The *Etna* is a similar establishment to the Vulcan, but on a somewhat smaller scale. It has facilities for melting six tons of metal. It is located on Frémont street.

The *Franklin* is also located on Frémont street. The engine used for printing the Evening Bulletin was made at this establishment. It has conveniences for melting 10 tons of metal, and employs 25 men.

The *Golden State* is located on First street, and is of about the same capacity as the Franklin.

The *Pacific* is an establishment reaching from First to Frémont street. It was commenced in 1850. The buildings, chiefly constructed of brick, cover two 50-vara lots. The machinery for the new rolling mills was made here, the fly-wheel for which weighs 25 tons. It can melt 20 tons, and employs about 75 men.

The *Miners'* is also on First street, and extends through to Frémont. It employs about 250 men, and can turn out a 20-stamp mill, boiler and all complete, in 30 days. The iron castings for the State capitol, at Sacramento, were made here.

The *San Francisco* is located at the corner of Frémont and Mission streets, where it covers a fifty-vara lot. All descriptions of machinery are made here. It can melt 15 tons of metal, and employs about 40 men.

The *City Iron Works* are located on Frémont street. Employ about 20 hands. Considerable machinery for the Sandwich Island sugar-mills has been made here.

The *California Foundry* is also on Frémont street. This establishment does an extensive business in architectural castings, which it makes a specialty. The fronts of several of the most elegant buildings in the city were cast here. It has facilities for melting six tons of metal, and employs about 20 hands.

The *Union Foundry*, corner First and Mission streets, is the oldest and largest establishment of the kind on this coast. It was commenced in 1849. The buildings include a three-story brick, having a frontage of 187 feet on First street, extending 275 feet, and fronting 120 feet on Mission, the whole covering nearly 50,000 feet; 300 men are employed here. The machinery for the United States steamer Saginaw was made at this foundry. The first locomotive made on this coast was cast and finished here.

The *Atlas Iron Works* are located on Frémont street. They are chiefly engaged in casting for agricultural purposes. Can melt seven tons of metal, and employs about 30 men.

The *Jackson Foundry* is located on Jackson street. Its operations are confined to casting stoves, ornamental railing, and other light and fancy goods. The ranges used in nearly all the first-class hotels in the city were made here. It gives employment to about 30 men.

The *Empire Foundry* is on Mission street, near Beale. All descriptions of machinery and castings are made here. It employs 30 men.

It is within limits to estimate the consumption of iron in California and the States and Territories dependent on it for supplies, at 30,000 tons annually. The business gives employment to nearly 3,000 men. There are 30 machine-shops in San Francisco, in addition to those connected with the above-named foundries.

The largest iron vessel ever cast in the United States was made at the Union Foundry in 1861. It was a shallow pan, capable of holding 1,316 gallons, and weighed 8,114 pounds. It was for use in one of the local soap factories.

A rolling-mill and steam forging establishment has recently been completed at San Francisco, with machinery and apparatus for making every description of bar and rod iron, from one-fourth of an inch diameter, and one-eighth of an inch thick, to 12 inches wide, of any shape required by manufacturers, including all sizes and patterns of railroad iron. This establishment furnishes a market for all the scrap iron that can be obtained. It is proposed to erect puddling furnaces for converting cast into malleable iron, as the supply of materials is not equal to the demand.

The above facts are sufficient to show that there exist on the Pacific coast a fair demand for iron and some facilities for its manufacture.

Imports of iron (chiefly railroad) into San Francisco during 1866, *and first six months of* 1867.

Description.	1866.	1867.
Pig iron, tons	9,388	2,063
Bars	157,558	100,378
Bars, bundles	40,088	30,229
Pipes	18,278	14,429
Pipes, bundles	14,584	7,451
Hoops, &c., bundles	31,985	19,607
Hoops, cases	395	394
Sheets, bundles	21,604	4,048
Sheets, cases	331	121
Plates	7,622	10,134

Exports of iron and machinery from San Francisco during 1866, *and first six months of* 1867.

Articles.	To Mexico.		To Sandwich islands.		To British Columbia.		To other countries.	
	1866.	1867.	1866.	1867.	1866.	1867.	1866.	1867.
Iron, bars	1,577	500	2,012	......	300	77	83	138
Iron, bundles	648	229	432	12	37	167	16	18
Iron, pig, tons	......	......	10	......	......	......	......	......
Sheets, packages	33	......	14	......	......	......	......	......
Hoops, &c., bundles	177	......	383	......	......	......	......	......
Hoops, cases	254	......	23	......	8	......	......	......
Pipes, bundles	120	27	5	......	......	......	2	......
Pipes, pieces	......	121	......	......	12	98	30	......
Castings, pieces	36	......	107	......	......	......	......	......
Plates	40	......	......	......	14	......	56	......
Machinery, packages	2,482	2,342	......	......	47	155	54	......
Machinery, pieces	889	1,108	......	......	......	......	207	7
Machinery, cases	396	......	......	......	......	......	19	......

COAL.—The importance of coal as an element of national and local prosperity is so generally recognized, that it is unnecessary to make any remarks touching the advantages of an abundant supply. But the relative value of the several varieties of coal for domestic and manufacturing purposes not being so generally understood, may render some explanations on this point appropriate.

The varieties of coal to which England owes its prosperity, and which are so abundant in Pennsylvania and other Atlantic States, do not exist, or at all events have not been found, on the Pacific coast. But there are extensive beds of other varieties, which differ as much in their composition and heating qualities as the coals of other countries differ from each other. In the northern parts of the coast the coal is as superior to that found at Mount Diablo and further south as the Welch coal is to the Scotch, or the Pennsylvania anthracite to that found in Ireland.

Modern geologists have abandoned the idea that coal, to be of good quality, must be found in one particular formation. Experience, the most reliable guide, contradicts such a theory. Researches in India, China, Australia, New Zealand, Chili, and on this coast, prove that good coal, adapted to nearly all purposes, is found outside of the carboniferous formation. Science has failed to demonstrate that good coal may not be found in any geological formation. There are many reasons for believing that when the mines on this coast shall be worked to a depth approaching that of the mines in other countries, the quality of the coal will be found to bear a favorable comparison. Analyses made by Professor Blake and other scientific gentlemen, of coal taken at a greater depth than the samples tested by Professor Whitney, in 1861 and 1862, shortly after the California mines were opened, exhibit a marked improvement.

The following reports exhibit the change in composition of the Mount Diablo coal as the depth of the mines increases:

Analysis of sample of coal from Pittsburg mine, taken from thick seam, 600 *feet from surface, in* 1867, *by Professor W. P. Blake.*

Moisture	3.28
Bituminous matter	47.05
Fixed carbon	44.90
Ashes	4.71
	99.94

There was no trace of sulphur in the sample.

Analysis of coal taken 800 *feet below surface on the incline in Black Diamond mine, in May,* 1867, *by Professor Price, superintending chemist to Golden City Chemical Works, and to San Francisco Refining Works, &c., &c.*

Moisture	9,54
Ashes	8.25
Sulphur	3.25
Oxygen and nitrogen	20.50
Hydrogen	3.75
Carbon	54.71
	100.00

Analysis of Mount Diablo coal, taken from near surface, in 1861 *and* 1862, *by Professor Whitney, State geologist of California.*

	Clark's mine.	Black Diamond mine.	Cumberland mine.	Peacock mine.	Corral Hollow mine.
Water	13.47	14.69	13.84	14.13	20.53
Bituminous matter	40.36	33.89	40.27	37.38	35.62
Fixed carbon	40.65	46.84	44.92	44.55	36.35
Ash	5.52	4.58	0.97	3.94	7.50

It will be seen by comparing these reports that the proportion of moisture in this coal is much less in the recently examined sample. This change in composition increases the power of the coal for generating steam and other purposes at least 25 per cent. It was the excess of moisture in the coal taken from near the surface that caused it to crumble on exposure to the air, or when thrown into the fire. These defects decreasing with increased depth of the mines, the value of the coal increases in proportion.*

There is a very material difference, however, in the quality of the coal taken from each of the seams in the Mount Diablo mines, as well as between this coal and that obtained from other mines on the coast, leading to the inference that each is separate in origin.

The Clark or upper seam at Mount Diablo is enclosed in soft sandstone above and below, with scarcely any shale or slate. The Bleach Diamond, or lower seam, is overlaid by three or four feet of slate and shale, and underlaid by two seams of tough clay, separated by slate highly charged with sulphur, while the coal is comparatively free from that element. The middle seam is divided by slate and contains a large per cent. of sulphur.

The following are the prominent traits of the coal found on this coast: The Mount Diablo, California, is an inferior quality of coal, but answers tolerably well, where bulk is no great object, for generating steam. Being cheap it is used to a considerable extent for domestic purposes.

The Nanaimo, Vancouver's Island, is excellent for generating gas. It is also extensively used for steam and domestic purposes. It burns with less smoke than Mount Diablo coal, but leaves more ashes.

The Bellingham Bay coal is considered the best on this coast for domestic purposes, as it is tolerably free from odor, and burns with a bright cheerful flame and very little smoke. It may be compared with the lower grades of English coal. The mine is in Washington Territory.

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* In this connection it may not be uninteresting to give results of an analysis made by Messrs. Falkenau & Hanks, San Francisco Chemical Works, of some Saghalien coal from East Siberia, with a comparative table of the results obtained from different kinds of coal, as to their constituents, and the effect obtained in their use:

Designation.	Specific gravity.	Volatile combustible matter in 100 parts.	Fixed carbon in 100 parts.	Earthy matter in 100 parts.	Comparative evaporative power in 100 parts.	Rapidity of action.	Readiness in getting up steam.
Lehigh, (Pa.)	1.590	5.28	89.15	5.56	8.35	792	153
Cumberland, (Neff's)	1.337	12.67	74.53	11.34	8.82	877	298
Cumberland, (A. & T.)	1.333	15.53	76.69	7.33	10.00	828	506
Sydney	1.338	23.81	67.57	5.49	7.47	764	424
Newcastle	1.257	35.83	57.00	5.40	8.09	827	595
Coal analysed	1.288	35.70	56.45	6.05	....	....	....

We have also examined the sample of coal forwarded by you, with a view of determining its commercial value, and have arrived at the following results:

Specific gravity	1.2887.9
Volatile combustible matter	35.70
Moisture	1.8
Fixed carbon	56.45
Earthy matter	6.05

Amount of gas evolved by 10 pounds avoirdupois of coal, 32 cubic feet.

The amount of sulphur contained in the sample was so minute as not to warrant a quantitative determination. In regard to its constituents, the coal examined seems almost identical with that of Newcastle, England.

On igniting the coal, cakes forming a light solid coke, yielding fine reddish gray ashes, which did not show the least tendency to form slag, but passed freely through the grate, were produced.

The Coos Bay, Oregon, is a fair coal for many purposes. When first taken from the mine it appears as compact and solid as "cannel," but as it contains a large per centum of moisture it soon loses this appearance, and crumbles when exposed to the air. It leaves but little ashes.

The Fuca Straits, Washington Territory, coal is moderately well adapted to steam or manufacturing purposes, burning with a bright, clear flame and but little smoke, leaving but a small quantity of dark sandy ashes. This coal "cakes" a good deal, which is its chief defect.

The coal found farther north not being much used in California, its traits are not well understood.

It is found by experience that the coal of this coast is less destructive to boilers and grates than the anthracite imported from Pennsylvania or the bituminous coals of Australia.

The article on the geology of the coal formations of the Pacific coast, furnished by Mr. W. M. Gabb, of the California State Geological Survey, and published in the previous report, gives much general information on this branch of the subject, and may be referred to for geological details respecting the formations in which coal is found on the Pacific coast.

New Discoveries in California.—A company has been organized within the past few months for the purpose of working a seam of coal recently discovered near the mouth of Bear creek, a tributary of the San Lorenzo, a few miles above Santa Cruz. The seam is stated to be nearly five feet thick, and the quality good for surface coal.

It may be well here to state that coal is much influenced by the atmosphere. Experiments made by the Peninsular and Oriental Steamship Company of England, prove that coal obtained from the best mines in that country loses 20 per cent. of its heating power when exposed to the atmosphere for a few months in hot climates. The steamers belonging to this company, when in the tropics, consume one-fourth more fuel than when in the temperate climate of Europe. As the temperature of the atmosphere on this coast ranges as high on land during the summer months as in the tropics, it would be unreasonable to expect the coal found near the surface to be as good as it will be at a depth out of reach of atmospheric influences.

A seam of coal is being worked on the south fork of Clear creek, Shasta county, a few miles west of Piety Hill, and about 30 miles from the silver mines. It was discovered in 1863, but was not worked till the discovery of the mines in 1865 afforded a market for the coal, which is used to generate steam for the engines since erected. A shaft has been sunk on this seam about 60 feet deep, at the bottom of which the coal is found, about four feet thick, and of fair quality.

In this part of Shasta county there exists a belt of shales nearly a mile wide, tilted to an angle of about 25 degrees, which contains thin seams of coal. These might be made to yield a supply of fuel for local use.

Mr. John S. Royal, in January, 1867, discovered an outcrop of coal in Corral Hollow, San Joaquin county, about 30 miles south of Mount Diablo, in a ravine from which the previous rains had washed the soil to the depth of 25 feet. The seam, where exposed, is about eight feet thick. It is generally believed that the beds of coal worked at Mount Diablo pass through this locality. The cost of transportation and labor has heretofore prevented the working of coal with profit in this vicinity. The projected railroad from San José to Stockton passing within four miles, and the San Joaquin river being accessible by a wagon road, it is probable the new discovery may at some future time prove valuable.

Nearly 1,000 tons of coal were taken from mines in this vicinity in 1863—200 tons of which came from the Commercial, and 800 tons from the O'Brien. The quality was good and well adapted for generating gas.

In 1866 a company was organized for the purpose of distilling oil from this coal, of which it is said to contain 65 gallons to the ton. The quantity of water that entered the shaft, and the want of proper pumping machinery, caused a suspension of operations. It is possible that with proper machinery the coal deposits of Corral Hollow might be profitably worked.

Clark, Bruce & Company have recently discovered three seams of coal on the west side of Butte mountains, on the Colusa road. The position and other conditions lead to the supposition that these seams may be continuations of those worked at Mount Diablo. Samples of the coal tested at Marysville gave satisfactory results. The work of prospecting is being carried on.

Deposits of coal have been discovered in San Luis Obispo county, in the Salinas valley, about 70 miles from Monterey. The coal crops out in a small oval valley about a mile in length, at the head of the Salinas. There are six or seven distinct seams in this outcrop within the distance of 300 feet. The formation has been considerably dislocated and the strata tilted up, but the outcrop may be traced for 20 miles. The third seam from the top is nearly seven feet thick, and has been examined to some extent. The coal is a lignite. The lowest seam in the series is about five feet thick and has also been examined by means of a short tunnel. The other seams vary from 10 inches to four feet in thickness.

THE MOUNT DIABLO COAL MINES are located on both sides of a high ridge which projects from the north side of Mount Diablo. They are favorably situated for access to navigable water, being in Contra Costa county, about five miles south from the San Joaquin river, at a point where it is deep enough for vessels of 1,000 tons to approach the bank.

The first mine in the district—the Teutonia—was located in 1858. Though coal was discovered there in 1852, none of the valuable mines were located till 1859. Several of the most productive have been located since 1860. It will be perceived by these dates that California coal mining is still in its infancy.

The majority of the locations have been made on the outcrop of coal, which is traceable for several miles, trending easterly and westerly. The Peacock mine is on the western edge; the Pacheco and San Francisco are west of the Peacock but not on the outcrop. The disturbed condition of the seams has caused the abandonment of these three western mines. The Cumberland, or Black Diamond, one of the most valuable mines in the district, is located about three-quarters of a mile to the north of the Peacock. Somersville, a small town created by the working of the mines, is situated about a mile to the east of the Black Diamond, from which it is separated by a high ridge, and is the centre of operations at present. This place contains about 200 buildings, including hotels, stores, a temperance hall, and a school-house, and has about 800 inhabitants. Within half a mile of it are the mouths of five different mines, from which coal is, or has been, extracted. On the northwest is the Union, a short distance from which is the Manhattan; a few hundred yards further east, and somewhat lower down the side of the ridge, is the Eureka; southeast of this, in a ravine at the base of the western side of the ridge, is the Pittsburg; about 1,000 yards to the north of this, and still lower down in the ravine, is the Independent. All these mines thus clustered together about the sides of a steep, rugged mountain present a singular appearance. The lofty chimneys of the steam engines belching forth columns of dense black smoke; the dark, dingy dwellings of the miners and those who minister to their wants; the tall trellis-like viaducts across the ravines, over which the locomotives are constantly passing between the mines and the wharves; the clanking of machinery, and busy hum of workmen and teamsters; the great piles of black waste at the mouth of each mine, all tend to give a peculiar interest, if they do not impart much beauty, to the scene. The distant view of the surrounding country, as seen from the ridge, embraces stretches of grassy meadows teeming with cattle and sheep; purple hills breaking in rugged outline against the sky, and glimpses of the San Joaquin meandering through its tule banks, dotted with the white sails of sloops and schooners, while here and there a neat cottage embosomed in orchards and surrounded by yellow grain fields, presents a scene of quiet beauty, suggestive of the progress of civilization.

The Central mine, one of the first worked, but at present idle, is located near the base of the hill, three-quarters of a mile to the east from Somersville, from which place it is separated by the hill. The Pacific, the most recently opened in the district, is located near Marsh's creek, seven miles east of Somersville.

The above are all the mines at present in a state of development. The Mount Hope is on the Black Diamond Company's ground, of which that company resumed possession in August last, and is not described as a separate mine.

The mines now producing coal are the Black Diamond, Union, Pittsburg, Independent and Eureka. The workings in these mines are extensive, some of the levels in one connecting with those in another, so that a person may travel a mile on the line of the seam.

It is estimated that during the six years ending July, 1867, 500,000 tons of coal have been taken from these mines. The quantity received at San Francisco, as shown by the following table, amounted to 302,554 tons, while the consumption on the ground, the waste in handling, &c., and the quantity sent to the interior by water and teams, will make up the difference:

Annual receipts of Mount Diablo coal at San Francisco.

	Tons.
1861	6,620
1862	23,400
1863	43,200
1864	37,450
1865	59,559
1866	79,110
First six months 1867	53,215
Total	302,554

The discovery of this coal has caused a reduction in the price of the imported article. In 1857 the average price of imported coal was $35 per ton. In 1867 the average price is about $15 per ton. A reduction of $20 per ton.

The Mount Diablo coal is used almost exclusively by the river, ferry, and coasting steamers, and by most of the stationary engines at San Francisco, and at places convenient to the rivers. The flour mills at Napa, Suisun, and other places, use it, and considerable quantities are consumed at Sacramento and Stockton. Shipments are occasionally made to the Sandwich Islands, where it is used for running the engines on the sugar plantations. During the first six months of 1867, 1,300 tons were shipped to Honolulu.

The working of the mines has created several prosperous villages in their vicinity, among which may be named Somersville, Clayton, Nortonville or Carbondale, and Pittsburg Landing, the terminus of the Black Diamond railroad, about two miles from Antioch and four miles from New York.

From the known dimensions of this coal field it is calculated to contain about 12,000,000 tons. It is probable its extent will be traced beyond the present recognized limits.

THE BLACK DIAMOND.—The company owning this mine was incorporated in 1861, and have worked their property continuously since. In August, 1867, the mine produced about 4,000 tons, which was its average monthly product for some time previously. It employs about 150 men. The coal is extracted through two levels, but there is another in progress which, when completed, will strike the vein about 800 feet below both the present adits.

The upper level is run on what is known as the Black Diamond seam, and is reached by a tunnel 430 feet in length, cut through the sandstone which encloses the coal. The workings on this level extend three-quarters of a mile on both sides of the tunnel. This coal seam is four feet four inches thick.

The second level is about 550 feet below the above, passes through the Clark seam, which is three feet six inches thick, and extends 300 feet beyond to the Black Diamond seam. The working on the Clark seam extends about half a mile on both sides of the tunnel and several hundred feet on the Black Diamond.

The third opening is being made by an incline, which will strike the coal about five hundred feet below both the other levels. It will cut the Clark and the Black Diamond seams. When this incline shall be completed this company will have a sheet of coal to work about 2,000 feet deep, running the length of their claim, nearly a mile. They also own the Manhattan, which they expect to work through the above levels by means of a drift now being cut.

In working the Black Diamond the miners pass through several bodies of coal of fair quality, but too small to work with profit, ranging from 12 inches to 18 inches in thickness, each being separated by a stratum of hard black slate. Two miles south of the tunnels on this mine the Black Diamond seam is found to be divided by two lenticular beds of tough clay, each from 10 to 12 feet thick, divided by a body of hard clay slate. This clay furnishes materials for the pottery at Antioch, and makes good fire brick.

The mine is worked by stoping and drifting, the men laboring by contract. Every facility is afforded by the company to take the coal out in as compact a form as possible. The arrangements for conveying it from the pit to the vessels on the river afford an illustration of California engineering skill. The mouth of the main adit is situated nearly midway up the side of a steep mountain, several hundred feet above the level of the plain. To overcome this obstacle, a massive incline has been constructed of framed timbers 900 feet in length, the angle of which is 15 degrees. A double car track is laid on the incline. By means of a stout wire rope passing over a drum, nine feet in diameter, the loaded car is made to haul up the empty one. A car carrying 20 tons of coal descending pulls up 10 tons of timbers and other materials used in the mine. The foot of the incline connects with a railroad over which the cars are hauled by a locomotive to New York, on the San Joaquin river, where the arrangements are completed for loading the fleet of vessels engaged in carrying coal to San Francisco and other places, without any further handling.

The railroad used by this company has no connection with the Pittsburg road, to be described hereafter; this latter is the property of another corporation. Its terminus on the river is four miles distant from New York.

THE PITTSBURG is worked by a stope cut at an angle of 30 degrees, by which the coal is reached at a distance of 350 feet. The monthly product is from 1,500 to 1,800 tons. The coal is hoisted by a horizontal winding engine of sufficient power to raise 200 tons per day.

THE PITTSBURG COAL RAILROAD.—In 1862 a charter was granted to a company by the State legislature to construct a railroad from the mines to the river. But little was done towards its construction till the summer of 1865. It was not completed and furnished with rolling stock till February, 1866. The road, a remarkable specimen of engineering skill, is only five and a half miles in length. From the mines to the plain, a distance of a mile and a half, the grade of the track is 274.56 feet to the mile. The four miles from the river to the base of the mountain is constructed on a gradient of 40 to 160 feet to the mile. To overcome the inequalities of the surface of the country eight trestle bridges had to be constructed, the most extensive of which is 340 feet in length; a tunnel 300 feet long had to be cut, and a number of heavy banks and culverts built. All the timber used in making the bridges is selected Oregon pine and California redwood. The rails, of English iron, are laid on square redwood ties. The gauge of the road is four feet eight and one-half inches. To overcome the friction of such a steep grade, two locomotives of a peculiar construction have been made at San Francisco. They have powerful engines and three pairs of 36-inch driving-wheels each, with cylinders 14 by 18 inches. Each weighs about 17 tons when loaded with fuel and water, which they carry themselves, having no tenders.

The total cost of the road is about $145,000.

All the mines in a position to do so have constructed side branches to connect with this road. It is estimated that it can deliver 3,000 tons of coal daily on board the vessels at the wharf. The coal is shipped from the cars to the vessels by shutes.

The friction on the brakes when the locomotives are coming down the incline is tremendous, but thus far no serious accidents have happened.

The coal from the Union, Pittsburg, Independent, and Eureka mines is carried by this road.

The Teutonia, the pioneer of the district, has been explored to a depth of 500 feet by means of an incline cut at an angle of 30 degrees. At this depth the upper seam of coal, two feet thick, was reached. A horizontal drift from the bottom of this incline strikes the Clark seam where it is 3 feet 10 inches thick. Another drift, run in an opposite direction, strikes the lower or Black Diamond seam. It is known that there are two other seams of coal in this mine, the lowest of which is about five feet thick. The want of cheap facilities for conveying the coal to market prevents the owners from working it to advantage. The company owns 640 acres of coal land; have good engines, pumps, and hoisting gear. The mine faces the property of the Pacific Company; the ground nearly four miles between the two mines is almost a level plain. The land belonging to the Pacific Company extends to the hills bounding the Teutonia Company's ground.

The Union.—Operations on this mine were commenced in 1861. The coal is reached by a stope, which, in July, 1867, was 500 feet in length, having a vertical depth of 230 feet. The seam averages three feet six inches in thickness, and is on the Clark, or upper seam. The monthly product ranges from 1,800 to 2,000 tons. The hoisting is done by a horizontal driving engine.

The Independent.—Work on this mine was commenced in 1861, though the coal was not reached till 1866, owing to the quantity of water that entered the shaft, the mine being the lowest in the district, and worked by a perpendicular shaft 700 feet deep. Upwards of $180,000 was expended for machinery, pumps, labor, &c., before the coal was reached. The pump in use at present, and which is barely sufficient to keep the mine dry, is driven by a 75-horse power horizontal engine, and lifts 130,000 gallons per hour. So great is the influx of water that a stoppage of the pumps for 24 hours would require 20 days' pumping to clear it. The hoisting and other machinery is powerful. The cages, or hoisting cars, each holding nearly a ton, are lifted by a rope four inches in circumference. About 200 car-loads are hoisted daily. The product of the mine averages about 1,500 tons monthly.

The Eureka is owned and worked by the Independent Company. About 160 men are employed in both mines. This produces about 1,500 tons per month, but could produce more. The company, in March, 1867, increased their capital from $500,000 to $3,000,000, in order to conduct operations on a larger scale, and have since made improvements.

The coal is obtained by an incline 600 feet in length, at an angle of 45°. It is taken from three seams. The upper, or Clark seam, is three feet eight inches thick; the middle, two feet six inches; and the lower, or Black Diamond, four feet. The two upper seams are passed through in reaching the lower one. The distance between the upper and lower varies from 225 to 350 feet. The Eureka uses a horizontal winding engine for hoisting.

The Central, which, prior to the construction of railroads by the Pitsburg and Black Diamond Companies, furnished a large portion of the coal sent to market, is at present idle. The slow and expensive transportation by teams places it out of the field in competition with mines having the advantage of railroads. It is in contemplation to construct a railroad to connect it and the Teutonia with the river. Both these mines are located on the same side of the mountain, and suffer alike from want of cheap transportation; both contain unbroken seams of coal; have been well opened, and have powerful machinery for working purposes.

THE PACIFIC, the property of a wealthy corporation of New York capitalists, is located about six miles east of Somersville, on the Rancho de los Meganos, or Marsh's ranch, as it is now called. The ranch covers three square leagues of land, embracing a portion of the foot-hills at the base of Mount Diablo, and extending to the San Joaquin river. Borings and other explorations have satisfied the engineers and agents of the company that the seams of coal worked in Mount Diablo pass in a nearly horizontal position under this ranch, covering a space of six miles square. A shaft is now in progress at a point near the western extremity of the ranch, several miles west of the disturbed formation in the Peacock, Pacheco, and San Francisco Companies' ground. It is calculated that this shaft will strike the Black Diamond seam at a depth of 400 feet. The calculation is based on the dip of the seam, which was reached by an incline sunk about 1,200 feet, from which the seam was prospected 200 feet laterally and found to average four feet four inches in thickness. The Clark and middle seams were reached in July last, dipping at an angle of 30°, leaving little room to doubt that the more important seam will be reached at a sufficient depth. The coal taken from the mine at present is used in running the machinery. The shaft in progress is intended to serve as the general outlet of the mine. Its dimensions are 16 feet by 8 inside the timbers. It is timbered all through and divided into three compartments, two of which are fitted for hoisting purposes. The centre serves as the pump shaft. It is estimated that when the mine is fairly opened and the machinery in operation, 20 tons of coal can be raised per hour. In July last, the shaft had reached 150 feet in depth.

The machinery was made at the Union Iron Works, at San Francisco. The pumping engine weighs 20 tons and is of 175-horse power, with three boilers, each 35 feet long and 42 inches in diameter. The pump is what is known as a Cornish "lift," having a six-feet stroke and 12½-inch bore. It is estimated to be capable of raising a body of water the size of the bore 1,000 feet.

The company have a lease of 13,316 acres of coal land. A railroad from the mine to the river is projected.

LABOR, WAGES, &c.—It is estimated that 1,000 men are employed in and about the mines at Mount Diablo. The miners work chiefly by contract. The general price for breaking out the coal is $1 per square yard. The men who perform this labor make from $4 to $6 per day. The unskilled laborers are paid from $40 to $65 per month, in gold. Board and lodging costs from $6 to $8 per week. No Chinese are employed.

The monthly wages paid by the several mines in this district aggregates about $50,000 or $600,000 per annum. The average cost to the companies for extracting and delivering the coal is $6 per ton, divided as follows: Miners' wages, hoisting, wear and tear, and interest on capital, or total cost of coal in the bunkers at mouth of mine, $3 50 per ton; freight by railroad to Pittsburg, $1 per ton; shipping from thence to San Francisco, $1 per ton; commissions and general management, 50 cents per ton.

The present market value of Mount Diablo coal suitable for domestic purposes is from $8 to $9 per ton. As only 80 per cent. of that placed in the bunkers is marketable, 20 per cent. being screenings, which are sold at $5 per ton, the margin of profit, after all expenses are paid, is very limited.

The above shows as nearly as can be ascertained the present condition and future prospects of the coal mines in California. It has not been a remunerative business to the capitalists who have engaged in it, owing to inexperience in the working of the mines, injudicious management, the high cost of roads to navigable waters, and the difficulties to be overcome in creating a market where the best imported coals had been so long in use. All these obstacles to success are gradually disappearing, and it is believed the coal interest in California will, in time, pay a fair percentage upon the capital invested in it. Incidentally it has been of advantage to the country, having furnished employment to a considerable number of laborers, created a demand for machinery, and supplied cheap fuel for domestic use and for purposes of manufacture and navigation.

THE COAL MINES OF OREGON.—A seam of coal was discovered in May, 1867, on the land belonging to Mr. Frank Cooper, in Marion county, about 30 miles from Salem. Considerable quantities of the coal have been sent to that city, where it sells readily. A wagon road is being constructed thence to the mine, in order to supply the demand. At the depth of 65 feet the seam is about five feet thick, and the quality of the coal better than at the surface. Good coal has been found near the Premier mills, on Bear creek, a tributary of the Yaquina river, in Benton county, about 30 miles west from Corvallis. Five separate seams of coal have been found in this locality, varying from six inches to four feet in thickness. The most valuable seam is within five miles of Yaquina bay. This is about four feet thick, and nearly horizontal in position. It has been prospected over a considerable extent of the adjoining country. It is estimated that coal in this vicinity can be delivered at $3 50 per ton, owing to natural facilities for working and transportation. Most of the mines are not more than five miles from navigable waters, and that distance over an almost level plain. A railroad could be cheaply constructed to the place of debarcation.

Towards the close of 1866 a seam of coal was discovered on the bank of Tillamook bay, 50 miles south of Astoria and 60 miles northwest from Salem.

There is another coal seam of a similar character on the shore of Nehalem, about 25 miles further up the river.

Extensive beds of coal are in progress of exploration about three miles from Farwell bend, on the Snake river. A tunnel has been run on a vertical seam about 300 feet, where a number of smaller seams connect and form a body of coal about 10 feet thick. The mouth of the tunnel is close to the bank of the river. Another seam of coal discovered, 200 feet above the original discovery, is said to contain good coal, and to be five feet thick.

Coal has been found in the Calapooya mountains, within a few miles of Barry's survey for a railroad from the Columbia river to California. This discovery is considered of importance in that part of Oregon.

There is a coal field on both sides of the Coquille river, in Coos county. The Coos Bay mines are in the northern edge of this field, which extends into Curry county. The seams, of which there are three, are thicker and the coal of a better quality on the Coquille river than at Coos bay. The two larger seams unite on the river and form a body of coal nearly 13 feet thick. There is another field between the south and middle forks of the Coquille, which is 1,600 feet higher in the mountains than the last mentioned. It has been traced for 22 miles in length by eight miles in width. One seam is 10 feet thick. The Coos Bay deposit extends about 25 miles north and south, and 20 miles east and west. It is most valuable on the south, but is only worked on the north.

COOS BAY COAL.—What is known as Coos Bay coal bears a good reputation in California. It is found in a number of seams which crop out on the surface of the ridge that divides Coos bay on the south from the Coquille river.

The locality of the best mine will be understood from a brief description of the bay. Coos bay is about 14 miles in length, varying from one and a half to two and a half miles wide. The main part of it has a direction northeast by southwest. At the upper end there is a sharp bend to the north. The Coos river rises some 30 miles inland and enters the upper end of the bend. Four miles from the mouth, in a densely timbered and hilly country, is Marshfield, the centre of the coal mining. The facilities for working the mines are crude. It the arrangements were more complete the supply of coal could be increased. There is a good entrance to the bay. The bar at its mouth has 14 feet of water at high tide, and there is a government light-house convenient. Four miles from the entrance of the bay, on the south shore, is Empire City, the seat of Coos county, a thriving little place.

The supply of Coos bay coal at San Francisco has increased during the past three years, as the following table will show. The consumption has increased in Oregon to an equal extent.

1865	500 tons.
1866	2,120 "
1867, (first six months only)	2,520 "

Coal in Washington Territory.—A seam of coal is being worked on the bank of the Cowlitz river, six or eight miles from where it unites with the Columbia. The Cowlitz coal differs in appearance and composition from other coal found on this coast. It is light, its specific gravity scarcely exceeding 1. It breaks with a bright glassy fracture, burns with a peculiar white flame and very little smoke, leaving but a small per cent. of white, powdery ashes. It contains no sulphur, does not soil the fingers in handling, makes a hot fire, which continues longer than most of the west coast coal. It cakes in burning and makes a considerable per cent of coke. Professor W. P. Blake has made an examination of this mine and coal, and considers them valuable.

A coal mine of some reputation is at Bellingham bay, near the northwest boundary of the Territory. About two years since it became the property of a San Francisco corporation, which had commenced making improvements for mining and exporting the coal, when, from some cause not clearly understood, the mine took fire. The fire could not be subdued till the underground works were flooded. This misfortune prevented operations in the mine for nearly a year, and caused a serious loss to the company. It was reopened in February, 1867. The first cargo of coal since the fire was received in May. Since that time the supply has steadily increased. The following table gives the quantity of coal from this mine received at San Francisco during the past three years:

1865	14,446 tons.
1866	11,380 "
1867, (first six months only)	1,275 "

The Fuca Straits Coal Mines are situated in the northern part of Washington Territory, on the south shore of the Straits of Fuca, about 45 miles southwest from Victoria and 40 miles southeast from the Pacific ocean. The company owning the mines possess 2,080 acres of the surrounding country. The land embraces the shores of Clallam bay for several miles. The surface of the country is exceedingly hilly and broken, and is covered with a dense forest of spruce, fir, and cedar to the water's edge. Its geological formation is exposed by several landslides of recent occurrence, some of them being quite close to the mine. It consists of sandstones and shales, with occasional conglomerate, the whole broken, divided, and tilted up in different directions by dikes of indurated sandstone. To such an extent has this displacement been effected that it is difficult to trace the continuity of the stratification. The largest bodies of the exposed strata dip toward the land at angles varying from 15° to 40°. The croppings of the coal are conspicuous from Clallam bay to Pillar Point, eight miles to the southeast.

The lowest seam is about two feet thick, and is seen some 60 feet above the water line of the bay, in the face of the hill where the mine has been opened. It dips towards the land at an angle of 35°. About 250 feet higher in the hill is another seam about 15 inches thick, and 300 feet still higher another eight inches thick. The mine is located on the lowest of these seams. The work done by the company includes a tunnel run into the face of the hill 70 feet, where it reaches the coal, at a convenient level for shipping. From this point an incline 250 feet in length has been run on the seam, the lower part of which changes its dip from 35° to 25°. Lateral drifts have been run 350 feet to the east and 180 feet to the west, the latter terminated by a thick sandstone dyke. Two dikes of similar materials were met in the other drift, one four, the other nine feet thick.

About 1,600 tons of coal were taken from this mine up to the close of 1866, when operations were suspended for want of funds to carry them on. In 1867 a company was incorporated for the purpose of working this mine, under the title of the Phœnix Coal Mining Company. Operations now give better promise of success. The original owners, having no other machinery than a hand pump and windlass, labored under disadvantages. The coal, owing to the expense of labor, cost $7 50 per ton, delivered at San Francisco. The new company, having pumps and hoisting gear worked by steam, can obtain it at less expense.

The first cargo, 600 tons, from this mine since it has been reopened, was received at San Francisco in August, 1867, where it sold at $12 per ton, costing the company $6 per ton to deliver.

The English government steamer Zealous has been supplied from this mine. The engineers of that vessel speak favorably of the coal, stating that it makes less soot in the flues and less ashes than any other obtained on the coast.

The new company have extended the workings on the original incline to 1,200 feet, where the seam is nearly four feet thick. In making lateral drifts from the bottom of the incline, the dikes mentioned as interfering with the workings on the upper levels were not met with, though these lower drifts were extended 200 feet northeast and nearly 700 feet northwest.

About 40 men are at present employed at the mine, who take out 100 tons of coal per week.

Investigations by experienced mining engineers and geologists lead to the conclusion that there is an extensive bed of coal in Clallam valley, of which the seams above described are but the margin.

A bore 292 feet deep was sunk in this valley in 1866, at a point about a mile and a half from the bay. It passed through the following formations:

	Feet.	Inches.
Sandstone	11	6
Till	1	0
Sandstone	5	0
Till	7	0
Hard sandstone	1	0
Beds of hard clay	5	0
Sandstone	48	0
Fire-clay	5	0
Sandstone	4	6
Till	1	6
Sandstone, in beds	8	10
Till	5	0
Sandstone	1	6
Till	6	6
Sandstone	3	6
Till	1	4
Clay, in beds	12	6
Hard freestone	0	10
Sandstone	13	6
Coal	0	8

Below this the bore passed through alternate layers of sandstone, shale, and conglomerate, till work was stopped for want of machinery.

It is a matter of some importance to ascertain the extent of the deposit in this locality, as the quality of the coal in Fuca Straits mine is such that a good supply of it is desirable.

Other Coal Mines in Washington Territory.—In July, 1867, the Coal Creek Road Company, of Seattle, Washington Territory, was incorporated under a special act of the territorial legislature, with a capital of $30,000, for the purpose of constructing a road and making other improvements for developing the coal mines opened to the east of that town. These mines are reported to contain excellent coal.

A seam of coal has been recently opened near Monticello, Cowlitz county, about 740 miles northeast of Mount Diablo. Some of it, tested on board the Oregon Steam Navigation Company's vessels, was found to be good for steam purposes, burning with a clear flame and but little smoke, leaving but a small residue of ashes.

Coal in Nevada.—It is believed by persons who have travelled over this State that good coal exists near its northern and western boundaries.

A seam of lignite is reported to have been found during the past summer a few miles from Hiko, the county seat of Lincoln county, near the Pahranagat district.

The surveyors employed by the Central Pacific Railroad Company report the existence of coal at the eastern base of the mountains near Crystal Peak, convenient to the Truckee river, in the immediate vicinity of the line of that railroad.

Parties prospecting for gold and silver among the Goose Creek mountains report croppings of coal at several places in that part of the State. The Goose Creek mountains are on the line of the Central Pacific railroad, above the valley of the Humboldt. Coal has been known to exist in these mountains for many years. The early emigrants who crossed the plains in 1850 frequently spoke of having seen it.

An inferior quality of coal is known to exist in the mountain ranges of western Nevada, and in the Walker river country.

Coal in Utah.—A seam of bituminous coal, about six feet thick, has been explored on Webber creek, a few miles from Great Salt Lake City. It is nearly horizontal in position, overlaid by strata of sandstone and a deposit of conglomerate.

Coal has also been found at Beaver creek, about 300 miles south from Salt Lake.

The Vancouver Island Mines are being worked to some extent. Exports in June from the Nanaimo mine reached 3,636 tons, and July 4,676 tons.

The imports of this coal at San Francisco during the past three years has been as follows: 1865, 18,181 tons; 1866, 10,852 tons; 1867, 9,160 tons, for first six months only.

Concluding Remarks.—The existence of coal along the northwest coast of the Pacific has been known since the discovery of the country. The seams cropping out in the face of nearly every bluff and promontory from Oregon to Sitka are too conspicuous to have been overlooked. The cost of and difficulty in procuring labor and transportation, as well as the lack of enterprise on the part of the settlers along the coast, have retarded the development of this important resource. The condemnation of valuable discoveries by pretended experts on account of presumed subterranean disturbances in the vicinity has discouraged capitalists from testing the value of many good mines. It is proper here to remark that the subterraneous disturbances on this coast are remarkably local in their effects, rarely extending for any considerable distance. The developements in the Mount Diablo district illustrate this fact. The section in this district on which is located the Peacock, Pacheco, and San Francisco mines is found to be so much broken and disturbed as to render the workings of these mines unprofitable, while to the north and south the coal has not been broken or displaced. It is, therefore, probable that many bodies of coal which are now considered too much broken to pay for development will be found valuable on more thorough examination.

The extent of the coal formation on the Pacific coast is surprising. Mr. Foucoult, a French gentleman, who spent several years examining the northern coast from Washington Territory to the newly-acquired territory of Alaska, states that anthracite exists at Skidegate inlet, Queen Charlotte's island, and that a seam of the same kind of coal is seen cropping out on the mainland opposite, about 40 miles distant. Specimens have been sent to San Francisco, where they were examined by competent persons, who pronounced them of good quality. The extent of these deposits is unknown, but they establish the fact of the existence of anthracite on this coast.

Vancouver's island contains sheets of coal, which may be seen cropping out at various points along its shores on the east and west. From Cape Flattery to Admiralty inlet, in Washington Territory, there is an almost continuous outcrop of coal. The Fuca Straits mine, described above, is only 16 miles from the croppings on Neah bay. Unfortunately this part of the coast is destitute of a good harbor, or doubtless the coal would have been developed to a much greater extent. But capital and engineering skill can overcome even this defect if the inducements are sufficient.

From the above data it will be seen that the coal deposits west of the Rocky mountains, though yielding an inferior quality of coal, are quite extensive, and furnish such promise of improvement as to justify the belief that the supply will be sufficient in the future for the demands of all branches of industry on the Pacific coast.

MARBLE, LIMESTONE, &c.—The use of marble for domestic, artistic, and funeral purposes is very general in California, especially in San Francisco. Marble mantels, tables, and slabs are to be found in almost every residence, workshop, and store. The graves of all, save the utterly friendless dead, are adorned with marble tablet or monument of some kind. This taste has created an important branch of productive industry.

There are fourteen factories engaged in the manufactures of marble in San Francisco, some of which employ 30 or 40 men. One has steam machinery for cutting and polishing the marble, and turns out 3,000 feet of slabs per month, in addition to tombstones, mantels, and other ornamental work. There are marble factories at Sacramento and Marysville, and one at each of the following towns in the interior: Stockton, Sonora, Petaluma, Santa Cruz, San José, Downieville, Folsom, and other places. Probably 1,000 persons are employed in California quarrying, transporting, and working marble.

The consumption in San Francisco averages 500 cubic feet per month; the factories in the interior use about one-fourth as much; total consumption in the State, say 600 feet per month, or 7,200 feet per annum. The average price of marble at present is $5 per foot. It thus appears that the value of the raw material used in this business amounts to $36,000 annually. The value of manufactured marble in the State is estimated at $2,500,000.

The most singular and suggestive feature in this business is presented in the fact that, although California contains an abundance of marble of great beauty and variety, most of that used in San Francisco is imported from Italy or New York. This fact may be attributed to the want of good roads and cheap transportation. It is found more economical to bring the raw material from Genoa, Italy, including transhipment at Bordeaux or Marseilles, than from the foot hills in the State, less than 100 miles from Stockton or Sacramento.

There are two firms in San Francisco engaged in the importation of marble. Brigadelli & Co. are in the Italian branch of the business. They own a vessel of 300 tons register, sailing between San Francisco and Genoa. Large quantities are brought by French vessels from French ports. From June, 1866, to June, 1867, this firm imported 545 tons of Italian marble and had 600 tons more on the way, the whole of which was sold, leaving orders still unfilled. The present price of Italian marble is 50 cents per superficial foot, in slabs of seven-eighths of an inch thick; in blocks of ordinary dimensions, $5 per cubic foot; blocks weighing several tons, at $6 per cubic foot. California marble cannot be laid down in San Francisco at these rates. Myers & Co. import Italian marble from New York, where it is brought in vessels from Genoa. This firm also imports white marble from Vermont, which sells at $15 per cubic foot, being used in the finer kinds of work. Some of the ornamental mantels in the homes of the wealthy cost $750 to $1,000 each.

The marble dust used in the preparation of effervescing beverages is imported from New York. Five hundred tons annually are consumed, at a cost of about $30 per ton.

The cost of transportation, which gives the imported marble a monopoly of the markets along the coast, prohibits its introduction in the interior. All the factories in towns above Sacramento, Marysville, and Stockton use the native marble, because it is cheapest at these places. With reference to the quality of the Pacific coast marble, as compared with the imported article, the fact should be taken into consideration that it is excavated from near the surface. None of the quarries have been opened to any considerable depth; consequently the marble is scarcely as fine in color or texture as it will be found at a greater depth. Much of it, nevertheless, when compared with the Italian, loses nothing by the contrast. Many samples of the California marble are superior. The block of white marble, from the quarry at Columbia, Tuolumne county, from which the sculptor Devine formed the bust of the late Senator Broderick, compares favorably with the Carrara in color, texture, and purity.

The recently-discovered quarries of black and white marbles near Colfax, Placer county, on the line of the Central Pacific railroad, will probably stop the importations from Italy. The beauty of the black marble from this locality, the exquisite polish it retains, and the advantage the owners of the quarry possess in railroad communication, which enables them to deliver it at San Francisco cheaper than the Italian, will probably give it the control of the market.

There are many localities in California where quarries of marble are known to exist, but, with few exceptions, they remain undeveloped. A belt of limestone traverses the State from north to south, between the foot hills and the Sierras, said to be 20 miles wide, forming a prominent feature in the topography of the counties famous for placer gold, particularly in Tuolumne, Calaveras, Amador, Nevada, El Dorado, and Placer counties. This belt abounds in white or grayish marble; and it is not improbable marble of variegated colors will be found on more thorough examination, as local causes are known to control the color. In illustration, it may be stated that in the gulch on the south side of the road between Columbia and Gold Springs, Tuolumne county, there are bodies of marble of a jetty blackness, colored by manganese; on Matelôt gulch, about a mile to the east, there is a deposit of marble which, through the action of salts of iron, has been mottled with red, brown, yellow, blue, and green spots; on Mormon gulch, about three miles to the west, are masses of marble of very fine texture veined with pale green by the action of chlorine. This variety of color is not peculiar to that locality, but may be observed throughout the State. The Suisun marble, of Solano county, and the black and white marbles recently found near Colfax, Placer county, are cases in point.

Little attention has thus far been paid to the marble quarries of the State, because the working of them has not been profitable, except in a few localities. As soon as railroads and cheaper labor shall remove existing impediments, they will probably become a source of profit, both to individuals and to the State.

The most important quarries at present worked are the following:

INDIAN DIGGINGS.—This quarry is located on the limestone belt, above referred to, in El Dorado county. It was opened in 1857. A considerable quantity of marble has been taken from it, darkly and coarsely marked with gray and black. It is very beautiful in large masses, but has a smeary appearance in small pieces; it is susceptible of a high polish, which it retains well. Monuments, after exposure for 10 years to the heat and cold peculiar to the foot hills of California, are as bright and glossy on the surface and edges as when erected.

The COLUMBIA is located on the same limestone belt, on the Tuolumne county side of south fork of Stanislaus river, near Abbey's Ferry, 70 miles from Stockton, the head of navigation on the San Joaquin river. This quarry was opened in 1860, and has been well developed. The quality of the marble is fine in grain and nearly white, with pale gray pencillings, and has improved with the depth of the workings. Blocks of 20 feet square, without flaw or blemish, may be obtained from this quarry. Machinery was erected for working it, and a mill built for cutting the blocks into slabs and polishing them. The works consisted of a revolving derrick with a boom 60 feet in length, by means of which two men could take blocks weighing 10 to 15 tons from any part of the quarry and place them on cars which ran on a track laid around it and connected with the mill. This mill had 100 saws and four polishing machines, moved by water power. Many thousands of tons of marble were cut here between 1862 and 1866. The increase of importations, erection of similar machinery at San Francisco, and the impossibility of sending the product to market during the winter, owing to the want of good roads, has caused the proprietors to cease operations, except during the summer. Some of the handsomest monuments in the State are made of this marble; that erected to the memory of the late Senator Broderick, in the Lone Mountain cemetery, at San Francisco, is a beautiful specimen.

THE COLFAX QUARRIES.—The most noted of these was discovered in 1866, in the mountains bordering the Bear river, about two miles to the east of the town of Colfax, Placer county, near the line of the Central Pacific railroad. The marble differs from all others found on the coast, being a dark gray, with jet black venation. When polished it is very beautiful. The mantels in the new Bank of California are made of this marble, which contributes to the beauty of the interior of that structure.

The proprietors of the quarry are among the first to derive direct benefit from the Central Pacific railroad, and their case illustrates how great an advantage that road will be in developing the resources of the State. Without such a means of transportation the marble could not be delivered at San Francisco for less than $20 per ton; with it freight is only $8 per ton. The owners of the quarry at Columbia pay $10 per ton for hauling their marble to Stockton when the roads are good, but from $12 to $15 per ton during the winter, with an addition of $2 per ton from that place to San Francisco by water. The expenses for transportation are still higher from the Indian Diggings quarry. Expense of transportation alone has thus far prevented the development of this valuable resource, and cost the State as much for imported marble as would have nearly paid for a railroad to the quarries.

There is a quarry of nearly white marble recently discovered on the Appleton ranch, about seven miles from Colfax and two miles from the railroad. Some fine blocks have been sent from it to San Francisco.

Both these quarries are in the limestone belt.

The SUISUN marble is found in the Peleoo Hills, a short distance north of the city of Suisun, Solano county. It occurs in the form of irregular beds, in a peculiar sandstone formation, and is of various shades of brown and yellow, beautifully blended in bands and threads, similar to the famous stalagmites of Gibraltar, which it resembles in origin and structure, as well as in appearance.

It has been formed by water, holding lime and iron in solution, percolating through the sandstone and depositing the mineral in cavities; consequently it is only found in limited quantity, though much of it, of an impure quality, is burned for making lime.

OTHER LOCALITIES WHERE MARBLE HAS BEEN FOUND.—A quarry of marble has been opened recently on Butte creek, about 40 miles from Oroville, Butte county, near the lately-discovered iron mines. The quality is good, the color gray and white, and the deposit extensive, being on the limestone belt.

There are other localities in the State where marble has been found, but the explorations have been too limited to determine their value.

In May, 1867, Mr. J. R. Brown discovered and located a quarry of marble a few miles north of Auburn, Placer county, of a nearly white color. Samples sent to San Francisco are considered fine. The quantity is abundant.

A marble quarry has also been found to the south of the Bay of Monterey, in the Coast range.

LIMESTONE AND LIME.—The supply of these materials is abundant in nearly all parts of California. The great belt of limestone so frequently referred to furnishes materials for lime for the towns in the foot hills and among the Sierras; while in the coast range there are other calcareous rocks, which supply the demands for lime in the towns and cities along the coast and on the plains. The consumption of lime at San Francisco averages about 100,000 barrels annually, three-fourths of which is obtained from the vicinity of Santa Cruz, on the ranch of the Cañada del Rincon, where there is a supply of white metamorphic limestone, which makes good lime. Considerable quantities are also brought from Sacramento. Since the completion of the Central Pacific railroad in that vicinity, lime is brought to San Francisco from near Auburn and Clipper Gap, Placer county. About 5,000 barrels are brought to Sacramento monthly by the railroad, and the supply is increasing with the facilities for its preparation and transportation.

The imports of lime at San Francisco, since 1864, have been as follows:

	Barrels.
1864	73,553
1865	90,037
1866	89,786
1867 (for first six months only)	67,840
Total	321,216

Average price during this time, $2 25 per barrel. The consumption of lime in San Francisco during the past three and a half years has cost $722,736. The increase of brick and stone buildings during the latter half of 1867 has greatly augmented the consumption of lime.

The construction of railroads and increase in buildings in the interior towns has also increased the consumption. The lime used for various purposes in the State annually probably exceeds $1,000,000 in value.

The Golden City Chemical Works, at San Francisco, have made a few tons of chloride of lime as an experiment, but the demand for this compound is so small on this coast that its manufacture is unimportant. It was ascertained in making these experiments that the California lime will not absorb as much chlorine as that made in the Atlantic States or Europe. This may be the effect of a variety of causes; but it is of importance, both in practice and to science. Some of the English lime will absorb 50 per cent. of chlorine. None obtained in California would take up 30 per cent. The general per cent. of chlorine in imported chloride of lime does not exceed 10. It loses its strength during the voyage.

OTHER CALCAREOUS MINERALS—SULPHATE OF LIME.—There are deposits of this mineral in various forms in all the States and Territories on this coast. It is valuable when burned as a fertilizer on heavy clay lands, such as constitute much of "tule" and "adobe" bottoms in California. It is abundant in the coast range. A body of it is found in the form of selenite in the hills near Stockton, within a few miles of the San Joaquin river.

Considerable quantities of the same mineral are known to exist in most of the mountains which have been examined for silver in Alpine county, among the the high Sierras.

Sulphate of lime, in the form of alabaster, is found in Tuolumne, Los Angeles, Solano, and several other counties.

Near Silver City, Story county, Nevada, alabaster of great beauty is found, but it soon crumbles on exposure to the atmosphere. In 1862 this deposit was quarried as marble. It was soon discovered that blocks cut from it fell to pieces, and were useless for building and ornamental purposes; but it makes good plaster of Paris.

Beds of friable sulphate of lime exist in the vicinity of the Sulphur Springs, near Red Bluffs, Tehama county, in the form of loose grains, deposited by the waters of the thermal springs, which cover acres of ground in the vicinity. All the hot springs on this coast deposit sulphate of lime, in some form or other.

In the Granite mountains, between Chico, in Tehama county, and Idaho, there are numerous deposits of gypsum. Anhydrate, or dry sulphate of lime, is found in Plumas and Sierra counties. Professor Whitney, State geologist of California, has various specimens.

Excellent materials for the manufacture of plaster of Paris exist on this coast. Considering the simpleness of its preparation it is remarkable that its manufacture has not been attempted. The imports of plaster of Paris amount to about 6,000 barrels annually at San Francisco, at an average cost of $4 per barrel, or nearly $25,000 per annum. Nearly all imported is from New York.

DOLOMITE OR MAGNESIAN LIMESTONE.—This mineral has been found during the present year, on the Merced river, between Horseshoe Bend and Don Pedro's bar. It is fine grained, of a yellowish gray color, having much the appearance of "Turkey stone," and is prized for hones for sharpening razors, penknives, &c. It has been mistaken for lithographic limestone. The deposits are abundant, and it may ultimately be found an important resource.

HYDRAULIC LIMESTONE.—California contains deposits of this valuable mineral, of good quality. The best known are found in a range of hills at the back of Benicia, Solano county. Hydraulic, or Benicia cement, as it is called, is made here in considerable quantities, a company having been incorporated in 1860 for the purpose of carrying on its manufacture. The company has good machinery, kilns, and the necessary arrangement for making several thousand barrels per month. An impetus has been given to this business by the action of the State harbor commissioners, who having charge of the construction of the sea-wall, in the harbor of San Francisco, have had experiments made with the various cements. The Benicia cement proving satisfactory, has been selected for use in the wall, which will be several miles in length, and of great depth and thickness, and will consequently require many thousand tons of cement. This action of the commissioners has had a tendency to remove a prejudice that had been cultivated by interested parties against the California cement. The imports of cement have been heavy for several years at San Francisco, the damp nature of the foundations in the business portions of the city requiring the bricks or stones to be laid in cement for several feet in extensive buildings. In 1866, 23,812 barrels were imported, at a cost of $91,648. During the first six months of 1867, 14,517 barrels were imported, at a cost of $50,000. These figures show the importance of this business.

The mineral in the vicinity of Benicia is found in a series of deposits extending for several miles. Though there does not appear to be any regular stratum of it, there is sufficient to last for many years, should the consumption reach 100,000 barrels annually.

Hydraulic limestone is a sub-carbonate of lime, which owes its value to its property of hardening under water, to a certain proportion of clay in its composition. Too much clay causes it to set too slowly, while too little renders it unfit for use as a cement. It is necessary to make this explanation to render the following statements intelligible:

There are two varieties of this mineral at Benicia, the one making a cement which hardens very rapidly, the other very slowly. Experience and observation prove that a combination of the two makes a hard, durable cement, which may be regulated to harden in any required time. Common limestone exists near the cement rock. The workmen first employed in making the cement, not being aware of the difference, mixed all together in the kilns; the consequence was to spoil the whole, and give the product a bad character in the market. But the processes for its preparation are now better understood, and the workmen more experienced. Such contaminations are avoided, and a really good cement is prepared.

This Benicia cement stone is of a dark yellowish color, speckled with black, tolerably soft; breaks with a dull, earthy fracture, without any appearance of crystalization.

The following table gives the results of some of the experiments made with various kinds of cements, to test the time each requires for "setting" in the air and under water:

Composition.	Time setting in air.		Time setting in water.	
1st quality Benicia cement	3	5	8	10
2d quality Benicia cement	25	30	30	50
Mixture of both	50	1.00	1.20	1.25
Roman cement	30	50	45	1.00
Eastern cement	1.00	1.20	1.50	2.20
Mixture of equal parts Benicia cement and sand	1.20	1.50	2.40	3.10
Mixture of one part of Benicia cement and two parts sand	1.50	3.10	4.10	5.25

This cement is much used in the manufacture of drainage and water pipes. There are several factories of these articles in California. Miles of such pipe are laid down in San Francisco. Other places in the Coast range and foot hills have been found where cement stone is known to exist. On the banks of Hospital creek, a few miles south of Corral Hollow, San Joaquin county, there is a deposit of it similar in appearance and composition to that worked at Benicia.

Within the past few months a hydraulic limestone has been discovered in Washington Territory, on the Columbia river, about seven miles north from Astoria. Works are in course of erection to manufacture cement at this place. There can be but little doubt that this mineral will be found abundantly all along this coast whenever an intelligent search shall be made for it. The metamorphosis of the rocks in the Coast range has been of a nature to form it extensively.

OREGON.—Limestone and marble are not so abundant in this State and the Territories north and west as in California. As mentioned in the report on iron, the Oregon smelting works have to import the limestone used in that establishment from the Island of San Juan. The limestone formation extending from Siskiyou to Los Angeles, in California, does not appear to extend into Oregon. At all events, its existence has not been reported.

The recent discovery of a bed of limestone on Beaver creek, Clackamas county, about 18 miles from the Willamette, is considered of much importance by the local press. It is presumable this mineral is scarce in that part of Oregon.

Nevada.—In addition to the alabaster mentioned above, in Story county, cement rock has been found in the Pinewood district, Humboldt county, and at many other places. No marble has thus far been found in this State, but there is sufficient carbonate of lime in other forms, in nearly all parts of it, to supply material for making lime for building purposes.

Building Materials.—The mountainous nature of the Pacific coast, and the geological formations to which the rocks composing the mountains belong, suggest the existence of a great variety of building materials. Few countries possess greater abundance or variety of these materials than California, and there are few cities in the United States where equal opportunities are afforded for comparing the merits of the materials used in other countries with those obtained at home, than are presented at San Francisco. In the early days of this city everything was imported, from bread and clothing for its inhabitants to lumber, brick and stone for their houses. The city hall is built of Australian freestone, several of the banks and other large edifices are built of China granite, and there are hundreds of steps, pillars, lintels, and other portions of buildings, of sandstone and granite imported from the Atlantic States and Europe. The foundations of many of the old buildings in the city are laid on imported bricks. None of these materials are found to be as durable or as handsome as those since obtained in California. In this, as in other mineral resources, the cost of labor and transportation has impeded development. It is only under favorable conditions that stone for building will pay to ship to San Francisco from the interior of the State; while the cheapness, excellence, and abundance of the lumber, and the general adaptability of the soil for the manufacture of bricks, cause these materials to be used for building almost everywhere throughout the State. The introduction of iron mouldings for the decorative portions of large structures prevents a demand for stone for such purposes. The Bank of California building, at San Francisco, is the only structure of cut stone of any magnitude, outside of the government fortifications, on the Pacific coast. Under such circumstances little attention is paid to opening quarries to test the quality of the stone. The consumption of stone is confined to granite for curbing and paving the streets, and the basements and steps for a few of the more costly buildings at San Francisco.

The following details concerning the supply of building materials will show how varied and valuable they are in California:

Granite.—Quarries of this rock are in nearly every county, including portions of the foot-hills or sierras. But as none of them are convenient to railroads or rivers, except the following, only these will be referred to:

The oldest and best known is located near Folsom, Placer county; another quarry worked to some extent exists at Natoma, in the cañon of the American river, a few miles from the first; another at Rocklin, 22 miles from Sacramento; and a fourth at Penryn, 28 miles from that city. The last two are on the line of the Central Pacific railroad.

There is a marked difference in the appearance of the rock from these several quarries. That from Folsom is hard and dark, containing feathery crystals of black hornblende in patches, on a dark bluish-gray ground of quartz and feldspar. Very little mica exists in any of the California granite. That from Natoma is as dark as that from Folsom, but the components being more evenly distributed gives it a lighter appearance. The stone-cutters consider this the best rock for smooth blocks. It has a clean and fresh appearance, never changing color. The granite from Rocklin is of a nearly snowy whiteness, remarkably fine grained, and free from stains and blotches, and is susceptible of a fine finish. The upper portion of the State capitol at Sacramento is being built of this stone. The mouldings and other architectural ornaments are cut with sharpness and elegance. The lower portion of the structure is built of the Folsom stone, which has a dark and dingy appearance in comparison with the lighter and marble-like stone above.

The fortifications in course of construction near San Francisco are being built of Penryn granite, which is somewhat darker than that from Rocklin, but lighter than the others described above. The basements of nearly all the large stores and warehouses in San Francisco are built of Folsom rock. The quarries at Rocklin are very extensive. It is possible to break off blocks of large dimensions—masses 100 feet long by 100 feet deep, and 10 feet thick, have been quarried out and afterwards split into smaller blocks, of any required thickness, across the grain, by means of gads and sledges. The rock splits evenly. There is a body of this rock several miles in length and breadth and of unknown depth.

In San Francisco are 10 stone-yards, at which about 350 men are employed dressing and trimming granite for building and paving purposes. These yards use about 400 tons of stone per month. The curbs and crossings of the principal streets are made of this rock. There are 20 miles of such curbing and cross-walks. The Central Pacific railroad carries about 5,000 tons of granite from Rocklin and Penryn to Sacramento, the greater portion of which is brought to San Francisco by schooners. About 1,000 tons per month are brought from the quarries at Folsom and Natoma.

The price of granite at San Francisco is $1 50 per cubic foot, or $21 per ton in blocks delivered at the wharf. The cost of trimming it is high; stone-cutters being paid $4 per day in gold for nine hours work.

SANDSTONES, &c.—Brown stone of good quality for building purposes is quarried near Hayward's, Alameda county. Some of this stone is used in the city cemeteries as bases for monuments and for building vaults. Its sombre appearance is considered an advantage.

Greenish-gray sandstone is obtained from Angel island, in the Bay of San Francisco. Of this beautiful stone the new building of the Bank of California has been built. The scroll-work and sculpture on the front are fine and smooth in outline as if cut in marble, while the color is soft and pleasant to the eye. Each pillar, lintel, and post of the doors and windows is formed of a single block, some of them 10 feet in length. The wheels used in the linseed oil factory at Steamboat Point are also made of Angel Island stone. These wheels are seven feet in diameter and 18 inches thick, each weighing five tons.

In several of the interior counties are deposits of a variety of trachytes, forming portions of table mountain, which make good materials for buildings. It is generally of a pinkish or gray color, fine in grain, and when first taken from the quarry is sufficiently soft to be trimmed with a common hatchet, but a few months' exposure to the air renders it quite hard. A valuable deposit is found near Mokelumne Hill, Calaveras county. Wells & Fargo's office, several hotels, and other buildings in that town are made of it. Some of these buildings are 14 years old, and the stones in them retain the marks and edges as when first made.

A quarry of freestone, of a pale drab color and fine texture, is found near Marsh's creek, six miles from the Mount Diablo coal mines.

Near the Merced river, in Mariposa county, on the road between Bear Valley and Stockton, there are beds of freestone well adapted to building purposes. The stone is of a pleasant pinkish tint, with wavy lines of brown and purple, and is compact and stands exposure well. With cheap transportation it would become a favorite for many purposes, as it can be cut cheaper than granite, and is better adapted to building than marble, and is more elegant and durable than brick.

BRICKS.—The manufacture of bricks is carried on extensively in nearly every county in the State. The tough clay of the Sacramento valley probably makes the best. Some of the earth used in one or two localities along the coast in early times, contained a per centum of soda and potash. Such bricks are ill-suited for a climate as humid as that of San Francisco. The moisture causes the alkali to exude, injuring the paint or plaster with which the bricks are covered.

The consumption of bricks at San Francisco amounts to about 100,000,000 annually. The average price is $12 per 1,000. About 20,000,000 are used annually in the interior of the State, at an average cost of $16 per 1,000. Until recently the bricks made were the product of hand labor. A brick-making machine was introduced in July, 1867. The increase of building consumes all that are made. The city corporation uses many millions annually in the construction of sewers, of which there are 10 miles within the city limits.

ROOFING SLATES.—Notwithstanding the abundance of slate on this coast, but little of it fit for roofing purposes has thus far been found. The use of shingles, asphaltum, and tin for roofing, which are so much cheaper and lighter than slate, is almost general, so that but little inducement is held out to furnish slate. In 1865 a company was organized in Amador county for the purpose of working a slate quarry found in that county. Experienced Welsh slaters were interested in the enterprise. They say the Amador slate is quite equal to any found in Wales. The causes above stated, together with the cost of labor and transportation, rendered the enterprise unprofitable, and it was abandoned. No doubt a proper search would result in the discovery of an abundant supply of roofing slates on this coast.

STEATITE, OR SOAPSTONE, though not strictly a building material, is classed under this head because it is valuable in various departments of arts and manufactures. There are localities in all the States and Territories on this coast, except Arizona, where this mineral is known to exist in great abundance, but its consumption is limited at present. Only one or two deposits are found profitable to work, and these only to an inconsiderable extent. There is but one establishment on the coast for the manufacture of articles from soapstone. This is at San Francisco, where it was commenced in 1866. As marble can be obtained cheaper than this stone, its use is confined to blocks for lining furnaces, slabs for the chemical works, linings for stoves, beds for ovens, &c. Its peculiar property of standing a high temperature, and retaining the heat a long time, makes it valuable for such purposes. About 200 tons are used at San Francisco annually; part of it in the form of powder by soap-makers, chemists, boot-makers, and others. Twenty tons of this powder are sold annually at $3 per 100 pounds. The price of the stone, in blocks, is $4 80 per cubic foot, or $40 per ton. In slabs of one inch thick, 75 cents per superficial foot.

Most of that used at San Francisco is brought from near Placerville, El Dorado county, where the company owning the factory have a claim containing 3,000 feet in length on a bed of this material 363 feet wide, and there are "extensions" on the same "lead" for miles on both sides of the original claim. Other quarries are worked to some extent—one near Sonora, Tuolumne county; another on Santa Catalina island, off the southern coast, near Santa Barbara; another on the south of the San José valley, near the city of San José, in Santa Clara county; another at Copperopolis, in Calaveras county, &c.

The cost of transportation from Placerville amounts to $12 per ton for freight alone, divided as follows: For hauling by team from quarry to railroad, nine and a half miles, $6 per ton; by railroad to Sacramento, 40 miles, $4 per ton; to San Francisco by steamer, $2 per ton.

The California steatite is superior to that obtained in the Atlantic States or Europe for many important purposes. It contains neither mica nor iron. The Golden City Chemical Works, an extensive establishment, uses steatite to line the retorts for distillation of nitric and sulphuric acids. When commencing operations this company imported steatite from New York, which, owing to its containing mica and iron, was soon destroyed by the fumes of the acids. Induced to try some of the California stone, it was found to last for a long time, the acids having but little effect on it.

Don Abel Stearns states that when he came to California, in 1825, the common people cooked their food in vessels made of this stone, which is abundant in all the southern counties, and almost as soft as wood. These "crocks" were made of various sizes, usually about an inch thick on the sides and two inches on the bottom. Such vessels are occasionally found by the surface miners in various parts of the State. Parcels of California steatite have been exported to China, where it is used for various purposes.

The furnaces at the copper-smelting works at Aubrey City, Arizona, are lined with steatite taken from Santa Catalina island.

CLAYS.—Under this heading will be included materials used in the manufacture of pottery, glass, colors, &c.

As already stated, reference can only be made to such products of the earth as are of immediate economical importance. Many minerals of interest and prospective value must necessarily be passed without notice, and several articles of dissimilar natures are included under one head, for the purpose of securing conciseness.

Clay, suitable for the manufacture of fire-bricks, is found beneath the coal in the Mount Diablo coal mines, in Contra Costa county; at Grass Valley, Nevada county; near Colusa, Colusa county, and at other places in California, Nevada, and Oregon.

Clay suitable for pottery is found near Marsh's creek, six miles west of the Mount Diablo coal mines; also at Pratt's Hill, near Ione City, Amador county, in the foot-hills.

The manufacture of pottery is carried on to some extent in all the Pacific States and Territories. In California there are factories of earthenware at San Francisco; Antioch, Contra Costa county; San Antonio, Alameda county; Monterey, Sacramento, San José, Santa Clara county, and at several other places. In Nevada there is a pottery near Virginia City, at which brownstone ware is made from clay obtained in the vicinity. There are several potteries in Oregon.

The establishment at Antioch was commenced in 1867. Various kinds of earthenware, both coarse and fine, are made here. It gives employment to about a dozen moulders and throwers, and a number of laborers. The potters work by contract, earning from $3 to $7 per day, according to their industry and the description of wares made.

The cosmopolitan character of the population of California is singularly illustrated by the articles made at this pottery. The French, German, Mexican, Russian, Chinese, and other nationalities represented here, each require differently-shaped crocks and pots in their culinary and other domestic arrangements. The storehouse of the pottery, in which a stock of these goods is kept, presents a curious medley of oddly-shaped articles made from designs to suit the tastes of all classes of customers.

Some of the moulded teapots, jugs, and water-pitchers, made in imitation of French and English ware, are very handsome, and exhibit the excellence of the material used as well as the skill of the workmen. Fancy articles of many kinds, cornices and mouldings, crucibles, muffles, fire-bricks, and tiles, drainage pipes, and a variety of other articles used by the local manufactories, are made here.

The clay is obtained from the deposit which underlies the coal at Mount Diablo.

The pottery at San Francisco is located at the Mission. Stoneware and utensils used by refiners, assayers, metallurgists, artists, and manufacturers are made here. The clay is obtained from a deposit near Michigan Bar, Sacramento county.

There is a bed of good fire-clay near Grass Valley, Nevada county.

KAOLIN.—Deposits of this clay are found in Marin, Amador, Tuolumne, Calaveras, and several other counties. It exists in many places in the coast range, the foot-hills, and the high Sierras. One of the most noted of these deposits is at Michigan Bar, Sacramento county. In El Dorado county there is a peculiar deposit of pure white clay, formed by the decomposition of the granite in the vicinity, which is well adapted to the manufacture of porcelain.

PIPE CLAY.—This material has been found near Dutch Flat, Placer county, and at San José, Contra Costa county; also in Tuolumne, Amador, and Calaveras counties, and at several other localities in the Coast range and foot-hills.

COLORING EARTHS, &c.—Terra de sienna, umber, red, yellow, and other ochreous coloring earths, are found in abundance and purity in many places in the Coast range and foot-hills of California. Several deposits have been opened. The colors prepared from them are varied and excellent. The limited market for their sale, and the importations from the Atlantic States and Europe, render their manufacture on a large scale unprofitable, though considerable quantities are used by the local painters and others.

The most noted of these ochreous deposits was discovered in 1860, near the town of Martinez, Contra Costa county. Six well-defined beds of ochre have been found in this locality, which range from 10 to 20 feet thick, and extend from El Humbre creek to San Pablo bay, a distance of six miles. In 1862 a company was organized to make colors from these materials. A factory, with a 20-horse power steam engine, for grinding the colors, was erected, and about 100 tons, of as many as 84 tints, from white to black, embracing a pale buff and bright vermillion, were prepared. But the causes above mentioned rendered the enterprise unprofitable, and it was abandoned within a year of its commencement. Some of the colors made are as bright to-day as when first prepared.

In 1866 a deposit of terra de sienna was found on Gold gulch, about six miles from San Lorenzo, Santa Clara county. Yellow ochre is found in the same locality.

There are bodies of coloring earth, red, purple, and white, about five miles west of Ione City, Amador county, which form a portion of what is known as Pratt's Hill, a promontory extending some distance into the Sacramento valley from the foot-hills.

Beds of sienna and umber exist in the mountains in the vicinity of San José, Santa Clara county. Fuller's earth is found in the same locality.

Red ochre is found on Red Rock, in the harbor of San Francisco, and at other places along the coast.

The above localities are named because the materials found in them have been used and are known to be valuable. But there are many localities where coloring earths, clays, &c., are known to exist, which are omitted because they have not been developed.

SANDS.—Since the introduction of the manufacture of glass at San Francisco, the quality of the sand along the coast has been tested in order to obtain a supply of such as is best adapted to this business. Much of the sand obtained along the shores of the harbor of San Francisco contains too much iron to be used in making glass. Near the harbor of Monterey there is an exhaustless supply, free from impurities. The sand used by the glass factories is imported chiefly from this place. A small quantity is obtained along the bay shore in Alameda county, near Oakland. Eight miles north of Santa Cruz there is a hill of white sand well adapted to glass-making, being free from iron and manganese.

The sand dunes, which form a peculiar feature in the scenery at some points in the bay of San Francisco, do not contain materials suitable for glass-making. The pinky hue of these dunes is imparted by the grains of iron they contain. They are not without value nevertheless. Parties owning them make as large a revenue from their product as is derived from equal quantities of fertile soil. This sand is adapted to building purposes, for which it is used. Small vessels are employed in carrying it to Napa and other counties where suitable sand is scarce. Such vessels are charged $5 per cargo. It sells at $1 50 per ton to brickmakers and builders in the interior.

The consumption of sand for glass-making is considerable. Two glass works at San Francisco make $250,000 of glassware annually, giving employment to about 150 men and boys. These works make nearly all the wine bottles, carboys, demijohns, pickle, spice, and sauce bottles, &c., used in California. They also make lamp chimneys, vials, and chemical glasses. The Pacific Glass Works was established in 1860, and has been enlarged during 1867. It recently made 12 retorts of white glass for one of the local chemical works, each of which holds 20 gallons; and 24 others of 16 gallons each, for another chemical establishment. These operations show the capacity of the glass works, as well as the extent of the chemical preparations made in San Francisco. Glass for the light-houses in this district was made at one of these factories. Preparations are nearly complete for manufacturing window and plate-glass.

PLUMBAGO, OR BLACKLEAD.—This mineral is found in several localities in California and Nevada. The largest deposit exists near Sonora, Tuolumne county.

As the exports from that place have recently assumed some commercial importance, a description of the principal mine there, and of the processes used to prepare the lead for market, may be interesting.

THE EUREKA PLUMBAGO MINE was discovered by its present owners in 1853, while they were working a placer mine in the vicinity. Its value was not ascertained, however, till 1865, when a process was discovered by which the earthy matter with which the mineral is contaminated near the surface could be separated. Since that discovery, several hundred tons of plumbago have been collected, nearly all of which has been exported to England, France, and Germany, the demand being very limited in California. The returns from the shipments to Europe have been satisfactory. The work of development has since been carried on successfully. The exports to Liverpool amounted to 300 tons between July and September, 1867, the estimated value of which is $100 per ton. There is some plumbago at present in course of shipment. The total quantity sent from the mine up to 1st of September, 1867, was about 500 tons.

THE MINE.—The lode or vein from which this mineral is obtained extends about 4,000 feet in a northeasterly direction, conformable to the general stratification of the country, and ranges from 20 to 40 feet in width. It is considerably broken up and mixed with the surrounding earth and rock to the depth of 30 feet from the surface. Below this it appears to be well defined between walls of sandstone and claystone. It dips irregularly to the east, in some places being nearly vertical, at others lying at various angles. The northern, or under side, rests on a stratum of coarse, pliable, yellow sandstone, which is much broken near the surface, but is compact and solid at a depth of 30 feet. The upper side is enclosed in a soft clay slate, which rapidly disintegrates upon exposure to the atmosphere, but is sharply defined and hard below. The lode is frequently divided by lenticular masses of this clay slate, from a few inches to several feet in thickness, which have their longer axis in the same direction as the lode. It is also divided by lateral dikes of sandstone, similar in appearance to the underlying wall rock, but harder. The whole formation abuts on the eroded carboniferous limestone, which forms a peculiar feature in the geology and topography of that section of the foot-hills which embraces Tuolumne, Calaveras, and Amador counties.

A shaft sunk on the lode to the depth of 65 feet, revealed the fact that the mineral is purer and more solid at that depth than near the surface. At the greatest depth reached it was found to be 25 feet wide, and much of it sufficiently pure to be shipped without any preparation.

PROCESSES FOR CLEANING THE ORE.—As stated above, a great portion of the mineral taken out below the surface influences is shipped without any preparation whatever. Two laborers extract and sack about two tons of the pure material daily. Such of it as is contaminated by admixture with the wall rock or the enclosed masses of clay slate is wheeled out, washed, and dried before shipment. All the operations in the mine are carried on in open cuts; everything taken out from the surface downwards being washed that is not pure enough to ship without such preparation.

THE SEPARATING WORKS.—These consist of reservoirs, settling vats, and drying frames. The chief washing apparatus consists of a sort of arrastra, or puddling machine, having a bed 20 feet in diameter, with water-tight sides three feet high. In the centre of this vat is a stout upright post with four arms set at right angles, to which are attached, by chains, four wooden frames with oaken teeth; like roughly made harrows. The teeth, or pegs, are only intended to stir up the materials, which readily separate in water. To grind them would render the separation difficult. A small water-wheel sets this apparatus in motion, and separates about 50 tons daily, the average of which produces 30 per cent. of pure graphite, which is separated by passing a small stream of water through the machine. The graphite, being finer and lighter than the sand and slate, is held suspended near the surface of the water, which passes out through a shallow spout near the top, taking the graphite with it, falling gently into a "sand box," a long, shallow trough, in which any remaining impurity is precipitated. From this box the water containing the fine particles of graphite is conveyed by iron pipes into large reservoirs capable of holding from 3 to 20 days' production. After remaining in these reservoirs for about 24 hours, the graphite subsides to the bottom in the form of a black slum, the water above being quite clear; this is let off by means of suitable arrangements for that purpose, till the sediment is only sufficiently fluid to flow, when it is run into a series of shallow vats arranged conveniently around the reservoirs. An exposure to the sun for 24 hours in these vats is sufficient to dry it to the consistence of tough clay, when it is cut up into irregularly-shaped blocks and placed on wooden staging for a few hours and becomes hard and dry, and is then put up in sacks weighing about 300 pounds each.

The capacity of the works at present is sufficient to turn out 500 tons per month, but it can be indefinitely extended to meet the demand. In addition to the puddling machine there are several small separating apparatuses, which are worked by hand, producing about five tons of blacklead per week.

The labor on the mine is performed by Chinamen, of whom there are about 30 employed, who are each paid $8 per week without board.

A great waste of material occurs from the want of experience in working; still the mine is profitable.

THE COSTS OF PRODUCTION.—The owners estimate the costs for excavating, washing, drying, and bagging the pure material at $1 per ton. The sacks used cost about $2 for each ton. Freight, by teams to Stockton, the head of navigation on the San Joaquin river, ranges from $8 to $9 per ton, (the distance is about 65 miles;) from Stockton to San Francisco, by steamer, $1 50 per ton; by sailing vessels, $1 per ton; from San Francisco to Liverpool, whence all that can be prepared is sent, the freight is from $12 50 to $14 per ton, or thus:

Cost of preparation per ton	$1 00
Bags, per ton	2 00
Freight to Stockton, per ton	9 00
Freight to San Francisco, per ton	1 50
Freight to Liverpool, per ton	14 00
Commissions, insurance, &c., per ton	12 50
Total costs	40 00

Its market price is about $100 per ton.

OTHER DEPOSITS OF GRAPHITE.—Other bodies of this mineral are found in California and Nevada, but they are all insignificant in value when compared to that above described. Among them is one within the limits of the city of Sonora, about a mile south from the Eureka mine. This has been worked to some extent. It is probably part of the main lode. There is another body of it on Jarvis's ranch, near Gold Springs, about four miles north from the Eureka, also supposed to be a portion of the main lode. It has not been examined sufficiently to test its extent. Small deposits of this mineral are found in Marin, Plumas, and Sierra counties.

A body of metamorphosed limestone exists on the border of Tomales bay, in the Coast range, which contains graphite in thin scales. There is a somewhat similar deposit near Summit City, Alpine county, among the lofty peaks of the Sierra Nevada.

Another body of plumbago is found near Fort Tejon, at the junction of the Coast range and Sierra Nevada.

The surveyors engaged by the Central Pacific Railroad Company report the existence of this mineral in the Truckee cañon, Nevada, also near Crystal peak. It has also been found in Storey, Washoe, Ormsby, and Lander counties, in that State, but generally of an inferior quality, though but little effort has been made to test the quality below the surface.

IMPORTANCE OF GRAPHITE IN THE ARTS.—Reference to some of the purposes for which this mineral is used in the arts and manufactures will exhibit the influence a full supply of it will have on these important branches of industry.

The manufacture of blacklead pencils gives employment to thousands of persons in Europe. Millions of these indispensable articles are annually imported. No suitable material for their manufacture has heretofore been discovered in our own dominion.

Crucibles made of this material are indispensable for melting gold and silver, because they withstand the high temperature necessary to melt these metals, and do not absorb the metal. It is also used in the manufacture of gunpowder. By coating the grains with graphite they are not only polished, but their explosive power is greatly increased. Good blasting-powder contains nearly one-tenth of its weight in graphite.

It is also of importance in the art of electrotyping, being one of the best known conductors of electricity for that purpose.

It is employed as an anti-friction for the bearings of heavy machinery.

Also, for covering the moulds for iron, brass, and bronze castings, imparting a smooth surface to these metals, and for numerous other purposes not necessary to particularize.

So much importance is attached to the supply of this mineral in Europe, that in 1860, when a Mr. Brockedon invented a process by which the powder from the European mines was solidified by hydraulic pressure, he was hailed as a public benefactor, and was honored by special marks of distinction from the highest scientific associations and many of the crowned heads of Europe.

The plumbago obtained in California is so much finer and purer than that prepared in Europe, that a demand for it has already been created.

When it is taken into consideration that the same pressure (50,000 tons) used to solidify the powder of graphite will also solidify iron filings, pulverized anthracite, and other impurities, it will be perceived that such a process affords a convenient means for adulteration; while the simple but effective process used in California leaves the graphite pure. This mineral will probably become in time an article of export.

SALT.—Next to coal, no mineral is more necessary to the prosperity of a State than salt. Of this article the States and Territories on the Pacific coast possess an abundance. But for the high price of capital and labor, and the difficulties of transportation, it might be produced as cheaply here as in other parts of the Union.

The following statement will convey an idea of the number of salt deposits on this coast and the extent of their development.

SALT IN CALIFORNIA.—The product at present reaches about 25,000 tons annually, about three-fourths of which is made in Alameda county, on the eastern side of the bay of San Francisco, where there are works for concentrating and evaporating the waters which cover the marsh land in that locality. These works extend from Centreville to the San Lorenzo creek, a distance of fifteen miles. They are the property of 17 companies, and some individuals. The aggregate capital invested is about $1,200,000. One hundred laborers are employed in the business during the season. The works are such as are usually constructed for obtaining salt from sea water, and do not require special description. Till recently the salt collected was of an inferior quality, but experience has effected an improvement. There are six steam mills in San Francisco, chiefly employed in cleaning and preparing it for domestic purposes. The capital invested in this branch of the business is about $250,000. These mills during 1866 ground and prepared 24,500 tons of bay salt, which will probably be exceeded during 1867.

The works commenced in 1860. The importation of foreign salt has since fallen off. The total imports for 1866 did not exceed 7,000 tons, about 5,000 of which were from Carmen island, Gulf of California, and 2,000 from Liverpool, which consisted of a refined article for table and dairy use. The quantity imported from England in 1867 is less than in 1866, in consequence of the local salt makers preparing a better article which they sell at a lower price.

Salt works are established in San Bernardino county, the products of which were formerly sent to the San Francisco market. But the cheapness of the bay salt and the costs of transportation from so great a distance have driven it out of this market, though it is used in the southern counties.

In 1867 works for collecting salt were erected near San Rafael, Santa Clara county.

Saline springs and marshes exist in various parts of the State, from which salt is obtained; but as it is consumed in the locality, no estimate of the amount can be made.

A spring about 14 miles from Los Angeles yields a good salt, shipments of which were formerly sent to San Francisco. Five hundred tons of it were received in 1866, but for the reasons given in the case of San Bernardino, it is now unprofitable to transport it so great a distance.

A deposit of salt is found in the Tehachepi valley, Tulare county, from which a small quantity was obtained during the summer of 1867.

Salt beds and saline springs are found in the valley of Kern river, Tulare county, 10 miles from the mouth of the Cañada de las Uvas. The country for miles is impregnated with salt. Holes dug in the ground during the wet season fill rapidly with brine, which deposits a coating of salt when dried during the summer.

The consumption of salt has increased in California during the last four years, owing to the demand created by new manufactures. The cod fishery in the Ochotsk sea, commenced in 1864, requires a supply of the coarse article. The vessels engaged in this fishery in 1865 cured 587 tons of fish; in 1866, 960 tons, and in 1867 will probably cure 1,000 tons.

The increase in pork and beef packing has increased the consumption of salt.

The success of the chlorination process for working auriferous sulphurets has also increased the consumption, the chlorine used being generated from this mineral. The chlorination works in the vicinity of Grass valley, Nevada county, consume about 1,000 tons per annum.

Farmers consume it as a fertilizer, for which it is well adapted on light, gravelly, or heavy loamy soils intended for wheat. They also use it in baling hay, &c.

The increased production of butter and cheese has materially increased the demand for refined salts. The returns of 42 counties for 1866 show a production of 2,250,000 pounds of butter. The product of cheese in 27 counties amounted to 1,601,782 pounds. The product of both butter and cheese will probably be one-half larger in 1867 than in 1866. These figures show the importance of the salt trade, and the reasons for predicting its future increase.

SALT IN OREGON is prepared from brine obtained from springs, of which there are numbers in the Willamette and Umpqua valleys, and at other places. Salt works are located in Douglas county, in the Umpqua valley, which for several years past have produced from 700 to 1,000 pounds of salt daily during the summer season. But the distance from Portland, the chief market, prevents the owners from deriving any advantage from that market. A cheaper supply is furnished from the works erected in the lower Willamette valley.

THE WILLAMETTE SALT WORKS are located about 13 miles from Portland, half way between that city and St. Helens, and half a mile from the banks of the Willamette slough. A range of low hills at this locality extend nearly east and west for about 20 miles, at the base of which are the salt springs. From one of them the brine used by the works is obtained. By means of a single furnace this spring yielded from 600 to 700 pounds of salt daily when the works were commenced; but for several months past it has yielded 4,000 pounds per day.

This salt is pure and white. Samples of it analyzed by Professor W. P. Blake were found to be free from lime and magnesia, making it peculiarly adapted for use in preparing butter, fish, and meats.

Mr. Blake took samples to the Paris exhibition, where it was admired for its crystallization, purity and color.

Springs in Jackson county produce about 10,000 pounds annually of a similar quality of salt.

Beds of rock salt are reported to exist near the base of Mount Jefferson, in the Cascade range of mountains.

SALT IN NEVADA.—There is probably no portion of the globe so abundantly supplied with salt as the State of Nevada. Thousands of acres of its surface are covered with saline marshes and beds of salt, and there are lofty mountains within her borders composed of rock salt of the purest quality. A detailed account of these deposits will be found in that part of the report relating to the miscellaneous resources of Nevada.

SALT IN ARIZONA, somewhat similar to that at Pahranagat, has been discovered near the Muddy river, about 100 miles from the Big bend of the Colorado. This body of rock salt is stated to be nearly a mile wide, several miles in length, and nearly 400 feet high.

SALT IN UTAH.—The Great Salt lake, in this Territory, is a prolific source of this mineral. Its waters are more saline than those of any similar lake known.

CARMEN ISLAND SALT is obtained from Carmen island, near the harbor of Loreto, Lower California, about 1,800 miles from San Francisco. This bed of salt is three miles in length by half a mile wide, and is the property of the Mexican government, who supply it to vessels at a stipulated price. It has recently been leased or purchased by the Holliday Steamship Company. It is similar in quality and appearance to that found at Sand Springs, Nevada. Like it the supply is perpetual. Every excavation fills with a fresh deposit in a few days. It is also solid, and has a pinky tint when taken out of the pits, but soon crumbles and whitens. California imports from 3,000 to 5,000 tons per annum.

THE PRICE OF SALT has greatly declined since the establishment of the works in Alameda county. The present prices are: Liverpool, stored, $25 to $27 per ton; Carmen island, $12 to $16 per ton; Bay, $8 to $13 per ton. These prices are an advance of 20 per cent. on Carmen island and Bay during 1866, the falling off in importations and increase in the demand having enhanced the value.

ASPHALTUM.—This mineral is abundant in California, but has not been found in any of the other States or Territories on the Pacific coast. Though generally admitted to be of the same nature and of the same origin as petroleum, and usually found in combination with that substance, it is different in appearance, and is applied to different purposes. As one of the mineral products of the coast, it is classed under a separate heading.

The principal deposits of asphaltum are found in Santa Barbara county. It is seen along the coast from the Kayamos river, the line of San Luis Obispo county, to the boundary line of Los Angeles. In this distance it assumes a variety of forms—hard as rock, soft as putty, oozing from the cliffs in lazy streams like molten pitch, or flowing clear and liquid like oil. There are reasons for believing that a deposit underlies the country embraced within bounds above given, and extending from Buena Vista lake to the sea. A spring of it bubbles up in the ocean several miles from the shore, opposite the northern end of the island of Santa Cruz.

Near Carpentaria solid blocks of it lie piled up on the sea beach, while near the Dos Pueblos ranch it is found as glassy and brittle as rosin. Near the mission of San Buenaventura the earth for many acres is covered with it in various stages of hardness. Deposits of a similar character are seen in the vicinity of the Santa Inez river, and in the valley of the Kayamos, to the eastward, and near Buena Vista lake, to the south.

The most accessible deposit is on the Galeta ranch, about nine miles from Santa Barbara. The residents of this part of the coast have supplied themselves with materials for roofing their houses and paving their streets from this deposit for the past 50 years, and quantities are annually sent to San Francisco for the same and other purposes.

It is estimated that the asphaltum here covers 300 acres, and extends some distance under the sea. Masses of it are seen enclosed in the rocks which form the cliffs along that portion of the coast. In some places it is quarried and carried in boats to vessels anchored at a convenient distance. At others it is gathered up along the beach, when it is loaded, in the following manner: The vessel waiting for a cargo is anchored some 300 feet from the shore. A hawser is fastened to the land; on this a large block is riven, by means of which a flat-bottomed boat is hauled to within fifty feet of the shore, just far enough to keep it out of the surf which breaks continuously on the open coast. The party on shore, having collected two or three tons, pile it on a cart with a single pair of high wheels, when three or four yoke of oxen, trained for the purpose, haul it through the surf to the boat, into which it is shifted. It sometimes happens that the cattle employed in this business are completely submerged by the rolling billows, but they appear used to it, and stand patiently up to their ears in the salt water. The boat, when loaded, is drawn to the vessel by means of the block on the hawser. This is a crude way of performing such work, and will soon be abandoned, as increase of business has induced some parties to construct a wharf of sufficient length to enable vessels to come alongside to load.

There are deposits of hard asphaltum at points between the rivers Gaviota and Buenaventura, a mile or two from the sea beach; also on the ranches of Laguna, Todos Santos, Los Alamos, and others, ranging from 30 to 50 miles from the sea; but none of these are used as a source of supply at present.

The Pacific Asphaltum Company have a quarry of this mineral six miles from Los Angeles, from which shipments are made to San Francisco. The asphaltum is hard and black, requiring to be blasted with powder to break out sufficient to supply the demand. In July, 1867, it presented a face 30 feet in depth by 75 feet in length, very compact and of good quality.

Previous to 1867 most of the asphaltum used at San Francisco was brought from Santa Barbara county, the rest from Los Angeles. Recently considerable quantities have been received from San Buenaventura. The latter article sells at $17 per ton when that from other places is offering at $15 per ton.

About 2,000 tons are annually used in San Francisco for making sidewalks and roofs of buildings, purposes for which it is well adapted when properly prepared. There are a dozen firms in San Francisco engaged in this business. It affords employment to about 120 men. It was introduced as a material for pavement in San Francisco in 1855. At the present time the principal thoroughfares have the sidewalks laid with it. Some of it, after a trial of 10 years, exposed to a variable climate, is still hard and smooth. It is also used for other purposes, and its consumption is increasing. The Spring Valley Water Company use it for coating their pipes, lining their reservoirs, &c., for which it is better adapted than cement or paint.

Many of the springs on this coast deposit asphaltum; others exude petroleum. None of the petroleum springs or lagoons north of Cape Mendocino produce asphaltum. Some of the springs in Santa Barbara and other southern counties do not deposit asphaltum, though in the midst of those that do. The petroleum spring on the Cañada Larga is an illustration of this latter class.

The deposits of asphaltum in California are sufficient to supply a very large demand. The present price (August, 1867) for asphaltum delivered at San Francisco is from $15 to $20 per ton. At the quarries and along the coast it may be had from $3 to $5 per ton.

During the summer of 1867 quarries of asphaltum were opened near Alviso, 10 miles north of San José and three miles from Santa Clara, in Santa Clara county. Both of these points are convenient to the line of the San Francisco and San José railroad.

PETROLEUM.—Differences of opinion between scientific authorities respecting the mode of occurrence, quality, and quantity of petroleum in California have impaired public confidence in this resource. Many persons have invested time and money in searching for "oil" in localities where it does not exist, because experts said it would be found there; while others have permitted good petroleum to run to waste because experts said it would not yield oil. It is not intended here to take sides with either the "oil" or "no oil" party. The discussion and its results are only referred to in order to show why this product has not been more extensively developed.

Mr. Gregory Yale, in his valuable work on Titles to Mining Claims in California, says:

> According to the results arrived at by the State geological survey, there are two questions settled in regard to bituminous oils: first, that with the facilities and conditions which now exist, asphaltum cannot be profitably used for the manufacture of burning or lubricating oil; and, secondly, that no fluid oil exists on the surface in sufficient quantity to pay for collecting in a large way.

Professor Whitney says the question resolves itself into this:

> "It is probable that flowing wells will be struck by boring, as in the oil regions of Pennsylvania, and that these will deliver a liquid oil or petroleum in sufficient quantities to take up the business and carry it on in a large way. The question, then, whether the geological structure and conditions in the Coast ranges south of San Francisco bay are such as to justify a large expenditure of money, in the expectation of striking copiously-flowing wells by boring to a considerable depth, is discussed and answered in the negative upon the following geological facts:
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> "The great bituminous slate formation, of tertiary age, extends through California from Los Angeles as far north as Cape Mendocino. No doubt it contains bituminous matter enough to supply the world for an indefinite period, could this be made available without expense. But it will be observed that the strata of this formation, all through the region north of the bay of San Francisco, are turned up at a high angle in this respect, occupying a very different position from the oil-producing beds in the eastern States. There the strata in which the petroleum is found in abundance, and in which all the wells which yield any considerable quantity of this material are sunk, are horizontal or inclined at a very moderate angle. Nowhere is oil obtained in large quantity where the stratum in which it originates is exposed to the air by being turned up on edge, or is only covered by light and porous accumulations of detritus. The reason of this is very evident: the oil is slowly elaborated or brought together in a certain bed or set of beds, and unless confined in some way so that it cannot escape, it must be forced to the surface by capillary attraction, hydrostatic pressure, or that of gas generated at the same time, when it escapes and is lost; to allow it to accumulate, there must be an impervious covering of rock over the oil stratum proper, which will confine the fluid material within limits, and allow it to accumulate away from the influence of the air. For this reason a large flow of oil on the surface cannot be considered as a favorable indication for boring wells, and much less can heavy accumulations of asphaltum be so regarded. If, then, flowing wells are struck in California, it is more likely to be in those portions of the region north of the bay of San Francisco where the bituminous slates are less disturbed and not set upon edge, and where they may perhaps be covered by formations of later age, which will act as covers and receptacles for the elaborated oil. In the Coast ranges

south of the bay of Monterey, as the bituminous shales are everywhere turned up on edge and have no cover of impervious rock, the inference is unavoidable that flowing wells, or at least those delivering any considerable quantity of liquid petroleum, cannot be expected to be got by boring to any depth; the probabilities, at least, are decidedly against it. While, therefore, we would not object to a reasonable and prudent expenditure of small amounts to test the question whether fluid oil can be obtained in California in sufficient quantity to pay a moderate profit on a *bona fide* investment, we would caution all against paying to speculators an immense premium for the privilege of making these experiments on lands which they have secured for a small sum, and where there are no better, if as good, chances of success as on many other tracts which have not yet fallen into the hands of these monster stock companies.

"Whether the asphaltum of California is derived from thickening or oxidation, by exposure to the atmosphere of exactly the same substance, chemically speaking, as that which is called petroleum in Pennsylvania, is a matter of chemical investigation. In the light of the facts and considerations just presented it does not appear to be economically important that it should be settled at once. How large a portion of the numerous hydrocarbons which are originally contained in the bituminous slates of California evaporate on exposure, and how many of them become oxidized into asphaltum, is a delicate subject for investigation. From the well-known fact that there are few, if any, deposits of asphaltum or asphaltic material existing on the surface in the oil region of Pennsylvania, although the oil itself appears to have been escaping at numerous points for an indefinite period of time, it appears to be probable, at least, that the original chemical constitution of the mass of bituminous matter in the oil-bearing shales of palæozoic age is different from that material which occurs in the tertiary rocks of California, and of which at least much the largest part does, on exposure, become consolidated into a hard and brittle material, which certainly no longer contains more than a very small percentage of light oil."

These conclusions have met with some opposition, which seems to resolve itself into a question of fact as to the existence of petroleum in small quantities, which is not denied, and does not refute the conclusion that it is useless to pursue an enterprise which will not prove pecuniarily profitable.

That petroleum exists in California is no longer a matter of doubt. It has been obtained at various places from Los Angeles to Humboldt, and merchantable oil has been made from several localities within this range, including San Mateo, Santa Clara, Santa Barbara, San Bernardino, Colusa, Lake, Napa, Tulare, Humboldt, Kern, and several other counties. The quantity available will probably be sufficient to supply the demand of the coast. The quality undoubtedly differs from that prepared in the Atlantic States; also the means for obtaining the crude material. Experiments made with oil from different sources show that it differs in composition from the eastern oils in containing a larger per centum of carbon. It burns with less brilliancy in ordinary lamps. With lamps so arranged as to give an increased supply of oxygen by creating a larger current of air through the chimney, it produces as bright and white a light as the oils from Pennsylvania, Virginia, or Canada.

The excess of carbon increases the value of petroleum for fuel, a use for which it is now attracting attention. In a country where fuel is dear an abundant supply of petroleum of this character becomes an important resource.

THE COMPOSITION OF CALIFORNIA COAL OIL.—In 1864, 20 gallons of crude oil from the Buena Vista springs, in Tulare county, were sent to Mr. C. Humphrey, of the Chemical College, London, to be analyzed. In his report Mr. Humphrey stated that it contained a small per cent. of illuminating and 80 per cent. of lubricating oil. "If the materials sent," adds the report, "were in their natural state, (which they were,) they are a most extraordinary product, and unlike anything that has been found in the United States or in Europe."

One hundred pounds of crude material analyzed by Mr. Benoist, a French chemist, gave the following returns:

Material of the density of 72° Baumé, or naphtha	7½
Material of the density of 65° Baumé, or benzine	7½
Material of the density of 44° Baumé, or illuminating oil	37½
Material of the density of 10° Baumé, or lubricating oil	37½
Asphaltum	10
	100

In 1866 the crude materials obtained from the Buena Vista springs yielded 50 per cent. lubricating and 40 per cent. illuminating oil. When obtained from the pits it was of the specific density of 20° to 25° Baumé.

A remarkable difference exists in the density of this material when obtained at different depths from the surface. On the surface it averages 18°; at 20 feet below, 22°; at 30 feet, 26°. The residuum in the stills after extracting the oil furnished fuel for future operations.

A sample of 30 ounces of crude oil from Mattole valley, Humboldt county, analyzed by Professor Rowlandson, a member of the English Royal Geographical Society, gave the following result:

	Ounces.
Illuminating oil	23
Lubricating oil	4.25
Residuum	2.75
	30

Upwards of 90 per cent. of merchantable materials.

There is a marked difference in the composition of the petroleum found in the northern and southern portions of California. Under the head of asphaltum it has been mentioned that the northern petroleum deposits no asphaltum, while the latter mineral is abundant in the southern counties. So also under the head of coal, the difference in the quality of that mineral in the north and south is referred to. Without entering into speculations as to the cause, the subject is of some interest to science. It is generally conceded that there is an affinity between coal and petroleum.

All the crude petroleum found in the coast range south of San Francisco is nearly identical in composition, though varying from 16° to 30° Baumé, and nearly all of it deposits asphaltum.

That found north of the Golden Gate is generally of a higher specific gravity and deposits little or no asphaltum.

There is no paraffine in most of the southern oil, while that from the north is prolific in this substance. The oil from the south contains a per centum of nitrogenous matter which is unusual in hydrocarbons. Some of it, when kept in open vessels in a warm room for a few weeks, generates a peculiar kind of worm, which would be remarkable if this oil be of a purely mineral character, as stated by the French chemist Berthelot.

Professor Silliman, in an article on this subject, read before the California Academy of Natural Sciences, in April 1867, stated the following interesting particulars on the subject:

> That he had made the experiments with a sample of surface oil obtained in Santa Barbara county, consisting of parcels from 5 to 10 gallons each, of dark, almost black material, which at ordinary temperatures resembled coal tar. Its density at 60° Fahrenheit was 13¼ Baumé, retaining a considerable quantity of water mechanically entangled, without any odor of sulphohydric acid, usually very decided in such surface oils. Distilled to dryness, it produced:

Oil having a density of 0.890 to 0.900	69.82
Coke, water, and loss	30.18
	100.00

> In one trial, the product was divided as follows:

Oil of density of 29° Baumé, at 52°	50.00
Oil of a density of 24 Baumé, at 58°	17.05
Coke, water, and loss	32.05
	100.00

> The coke was large in quantity, strong, and would make good fuel, resembling gas-house coke. The odor of ammonia was strong towards the close of distillation.

The illuminating oils obtained by these experiments, after treatment with sulphuric acid and soda in the usual manner, acquired an agreeable odor, a light straw color, and burned as well in a lamp as good commercial oil.

No paraffine could be detected by refrigerating the heavy oils in a mixture of salt and ice. It is, no doubt, the absence of this body from the series of products obtained from the California oils generally, that accounts for the illuminating oil burning well at a density considerably below the commercial standard for oil obtained from Pennsylvania petroleum—a difference enhanced also by the absence of any considerable quantity of light naphtha. The lubricating oils of this series, likewise free from paraffine, retain on this account their fluidity at low temperatures.

The light oils obtained in these experiments corresponded respectively to 12.96, 14.56, and 18.96 per centum of the crude oil. The total commercial products were about 60 per cent. of the crude body, which likewise yielded sufficient coke to supply the fuel required in the distillations.

The excess of carbon in the heavier hydro-carbons of California suggests the probability of their having a value in their crude state as fuel. For this purpose they may be employed to give cohesion to coke, or fine coal, or any other cheap form of carbon, as has already been done with coal tar in England.

THE MANUFACTURE OF COAL OIL IN CALIFORNIA.—Small quantities of coal oil have been made in this State for many years. The materials in some localities require but little preparation for illuminating purposes. Between 1865 and 1867, Hayward & Coleman, a firm in the oil business in San Francisco, made 40,000 gallons of illuminating oil from springs of petroleum near Santa Barbara; but suspended operations in June, 1867, because imported oil was selling at 54 to 55 cents per gallon, a price so low as to render the manufacture unprofitable, owing to the high price of cases to contain it, transportation, and labor.

These gentlemen have expended capital and labor in efforts to render valuable the California petroleum. After many experiments to test its adaptability for fuel, they state that, although it costs $5 per barrel to bring it from the springs to San Francisco, it is cheaper as fuel than coal or wood. It saves expense of hauling and splitting, and of feeding the furnace; it makes no ashes to be carted away; causes no waste in lighting or extinguishing the fire; while with wood or coal there is waste of time and material in these operations. The heat is under control, and may be easily regulated. The operations of this firm have been carried on for a year, with petroleum as fuel, for distillation and driving their engines, thus establishing the practicability of its use.

A number of establishments in the southern counties also use it for running machinery. A gentleman interested in the oil business has recently perfected an apparatus for burning it for domestic purposes. He has made application for a patent. This invention it is said performs the duty satisfactorily, burning the crude material without smoke or offensive odor.

Stanford Brothers have also expended capital and labor in efforts to manufacture oil from California petroleum, and have succeeded so far as to make oil; but not with profit. Up to July, 1867, this firm had made 100,000 gallons of illuminating oil, and a nearly equal quantity of lubricating, and have been making about 20,000 gallons of illuminating per month, since. Their works are still in operation.

For reasons stated, much of this oil is prepared to a standard density of 35° Baumé, which causes it to burn better, and exempts it from the tax of 20 cents per gallon levied on coal oils of 36°.

This firm purchase the crude oils from several localities, but obtain their chief supply from tunnels and pits near San Buenaventura. The high cost of vessels to contain the oil when made; of transportation and interest on capital, and the low prices ruling for the imported article, are impediments to the successful development of this resource.

It costs six cents per gallon for second-hand cans. New cans would cost 15 cents per gallon. Each 40-gallon barrel of crude material costs $3, or 7½ cents per gallon for transportation from the springs to the refining works. As the crude petroleum only averages 45 per cent. of marketable oil, each gallon of such oil costs 21 cents without the expense of refining, or the 20 cents for tax, or any allowance for commissions, loss, interest on capital, or other incidental expenses. For these reasons the interest is in a depressed condition. It is unprofitable to make oil when the imported article is less than 60 cents per gallon.

The material used by Stanford Brothers, in addition to the illuminating oil, produces about 25 per cent. of lubricating oil, which if it could be sold at 25 cents per gallon would make the other branch of the business profitable. But there is no market for it, owing to a prejudice against its use. The consumption of lubricating oil in California amounts to 500,000 gallons annually, including castor and China nut oils. That of illuminating oils reaches 900,000 gallons annually. Of course this creates an important trade for importers.

The Buena Vista Company made about 4,000 gallons of illuminating oil at their works near the springs, and other companies made more or less. Nearly a dozen companies had stills in operation for a short time. Mr. Stott has made about 5,000 gallons at San Francisco. Mr. Williams, of the same place, has also made about the same quantity. Altogether it is safe to estimate the quantity of California made coal oil at 175,000 gallons. The capacity of the stills for making it is sufficient to turn out 100,000 gallons per month.

The idea that the manufacture of California petroleum may yet be made profitable is not abandoned. A company was organized at San Francisco as recently as September, 1867, with a capital of $1,250,000, for the purpose of working petroleum and asphaltum deposits.

THE MODE OF OCCURRENCE.—The oils of California do not "occur" in the same manner as those found in the Atlantic States. Here there are no flowing wells, nor is it probable any will be found. Some of the wells sunk in the Mattole valley, Humboldt county, reached the depth of 1,166 feet without obtaining a flow, though sunk in a district overflowing with oil on the surface. Other wells of nearly equal depth have been sunk in other counties, through various formations, with similar results.

Without entering into speculations as to the cause of the abundance of oil on the surface, and its deficiency below, it is enough to know that oil exists in sufficient quantity. There are many natural wells or springs of it in the Coast range, some forming pools of oil; others showing but little more than "indications" of that material. From some of these springs petroleum flows in a black, viscid stream, like tar; from others, clear, colorless, and comparatively pure. In exceptional instances it has been used without preparation in common coal oil lamps. At some places the springs are widely separated; at others, scores of them are found within the space of an acre. Generally the single springs produce the most petroleum. About some are large deposits of asphaltum, while none of this mineral is seen within miles of others, though the oil has been flowing for centuries, and its course can be traced for miles along the surface.

Where a record has been kept the flow of petroleum has been larger during the night than the day, and more abundant in winter than summer. Usually where petroleum is found there are salt springs and alkaline waters.

Reference to the oil wells of San Fernando district, Los Angeles county, will convey a general idea of the oil formation in the Coast range.

This district is situated 30 miles northwest from Los Angeles. The formation lies in a range of mountains extending in a course nearly east and west. The central stratum is shale, which seems to contain the most oil, and inclines north and south at an acute angle, the top being from 150 to 200 feet wide, slightly depressed, and covered by a stratum of sandstone of variable thickness. This shale is bounded by a similar sandstone, alternating with thin seams of limestone and hard conglomerate. At the base of the mountains the formation is hard sand and limestone, both containing marine fossils of a recent era. These mountains reach a height of about 700 feet above the local river beds, and about 4,000 or 5,000 feet above the sea level.

The oil stratum varies in width, being in some places a mile or more, as in Rice cañon, in others only a few hundred feet; but is continuous for many miles. In the gulches and cañons, where the water has eroded the formation and exposed the shale to the action of the atmosphere, the oil is found oozing out. The water in the district is unfit for use. Oil is also found on the summit of the mountains, which are crested with shale, being carried through the shale by capillary attraction. At some places beds of "brea," or asphaltum, have accumulated, where the oil has evaporated. The rocks, forming beds of streams which dry up during the summer, are covered with a complex alkaline efflorescence.

The manner of collecting the oil in this district is by sinking pits in the vicinity of the natural springs, in which oil and water collect. The oil is skimmed off by hand, each pit of 20 by 20 yielding about two barrels per day. When collected it is dark green in color, and about as thick as sirup in summer, and contains about 80 per cent. of oily matter, mechanically combined with 20 per cent. of water, from which it is difficult to separate it.

In other places tunnels are run into the mountain. The oil drips from the slate when it is cut through.

The Buena Vista oil claim is located on a belt of bituminous shale from two to three miles wide, and from 30 to 40 miles long, running parallel with the Coast range, near Buena Vista lake, Tulare county. From this formation petroleum exudes at a number of places.

The oil obtained was the seepage of one of these springs collected in pits dug for the purpose. These pits are generally 20 feet deep, five feet wide by eight feet long, each producing about 300 gallons of crude materials in 24 hours, containing 40 per cent. of light, and 50 per cent. of lubricating, or heavy oil. The claim was worked from February, 1864, till April, 1867, when, owing to the low price of oil, it was found unprofitable to prepare it for the San Francisco market, and the local demand was fully supplied.

A notable difference exists in the density of the oil from this place when obtained at but slightly different depths from the surface, ranging from 18° Baumé to 22° at 20 feet, 22° and 26° at 30 feet.

Similar surface deposits are met with in nearly all the valleys of the Coast range.

It will be seen from this imperfect sketch, that although not occurring in the same manner as the earth oils of other countries, the California oils are nevertheless valuable for illuminating purposes. The cost of production is the material point which must govern the development of many natural resources of this State. It is a question that must be candidly met. So far as petroleum is concerned, it must be acknowledged the facts are against us. But cheap labor and increased facilities for transportation will naturally follow an increase of population. With capital and labor as cheap as in New York or Europe, California petroleum would be a source of wealth to the country. At present it is an unprofitable resource.

QUICKSILVER.—THE NEW ALMADEN MINES were so fully described in the preliminary report, that a brief reference to their present condition will be sufficient here.

The production of quicksilver in these mines has fallen off nearly one-half during the present year owing to various causes, the chief of which is, the limited demand for the article as compared with former years, and the increased production from other sources. A large quantity has accumulated in the markets of the world, estimated by some as high as 100,000 flasks. The mines of Almaden, in Spain, have furnished a large proportion of this supply; and the production has been considerable in Austria and South America.

The product of the New Almaden mines from January to August, 1867, inclusive, has been as follows:

	Flasks.		Flasks.
January	2,270	July	1,931
February	2,195	August	2,000
March	2,338		
April	2,169	Making	17,063
May	2,160		
June	2,000		

The present condition of the principal mine is poor, both in the quality and quantity of its ores; its future is uncertain, and any conjectures in regard to it would be valueless.

THE NEW IDRIA MINE yielded during the six months ending June 30, 1867, as follows:

	Flasks.		Flasks.
January	690	June	852
February	859		
March	915	Total	5,014
April	879		
May	829		

THE REDINGTON MINE, of which no description has heretofore been given, (sometimes called the XLCR, as named by the original locators,) is situated at Knoxville, Lake county, 55 miles northwest of Napa, from which point the product is shipped. It was located in March, 1861, but the locators having neither the necessary skill nor capital, leased the mine for a term of years. Work was commenced thereon in the spring of 1862, and energetically prosecuted, with various vicissitudes ever since, its product up to January, 1867, aggregating 9,009 flasks of 76½ pounds each, selling for a total of $344,594.

Up to January, 1867, the ore was reduced in retorts, but at that time there was completed a large and expensive furnace and condenser, constructed of a stone peculiar to the region, which proves itself quite the equal of the best English fire-brick in its capacity to resist the action of fire. By the aid of this improved means of reduction, the product has been largely increased, aggregating in the nine months from January, 1867, to October 1, 1867, 5,145 flasks of 76½ pounds each. A second furnace of equal capacity with that now used, and having many improvements never before introduced in the construction of quicksilver reducing furnaces, has just been completed, and the product is hereafter expected not to be less than 1,000 flasks per month. The mine is situated in a hill, and is worked by a tunnel about 700 feet long, not counting the numerous side drifts.

Various shafts have been sunk from these side drifts, and trouble being experienced from water, an artesian bore of seven inches diameter was sunk on the hillside before the mouth of the tunnel, to the depth of 250 feet. In this was placed a pump of five and a half inches diameter, and this, though generally looked upon at first as a very doubtful experiment, is found effectively and permanently to free the whole mine from water, thus saving the great expense of a pumping shaft.

The mine employs 150 men, has built and maintains 20 miles of road, and from its isolated position is compelled to create from its own resources all the facilities needful for carrying it on.

BORAX.—The production of refined borax by the California Borax Company for eight months, beginning January 5 and ending September 7, 1867, was 481,912 pounds. The present product averages about 120 boxes (112 pounds each) per week. The company is about to erect a machine to lixiviate the mud of the lake, at a cost of $30,000.

Mr. J. Arthur Phillips, a distinguished mining engineer from England, made a careful examination of the company's property last year. The following is an extract from his report on Borax lake:

> The borax occurs in the form of crystals of various dimensions, imbedded in the mud of the bottom, which is found to be most productive to a depth of three and a half feet, although a bore-hole, which was sunk near the centre to a depth of 60 feet, is said to have afforded a proportion of that salt throughout its whole extent.
>
> The crystals thus occurring are most abundant near the centre of the lake, and extend over an area equivalent to about one-third of its surface, but they are also met with, in smaller quantities, in the muddy deposit of the other portions of the basin, some of them being, in the richest part before alluded to, over a pound in weight. The largest crystals are generally enclosed in a stiff blue clay, at a depth of between three and four feet, and a short distance above them is a nearly pure stratum of smaller ones, some two and one-half and three inches in thickness, in addition to which crystals of various sizes are disseminated throughout the muddy deposit of which the bottom consists.
>
> Besides the borax thus existing in a crystallized form, the mud itself is highly charged with that salt, and, according to an analysis of Professor Oxland, when dried affords, in the portions of the lake now worked, (including the enclosed crystals,) 17.73 per cent. Another analysis of an average sample, by Mr. Moore, of San Francisco, yielded him 18.86 per cent. of crystallized borax.
>
> In addition to this, the deposit at the bottom of the other portions of the basin, although less productive, still contains a large amount of borax, but no analyses of samples appear to have been made, except from the portions of the bottom at present worked. It has further been ascertained, by making pits on the lake shore, that clay containing a certain proportion of borax exists in the low ground, at a considerable distance from the water's edge.
>
> EXTRACTION OF BORAX.—The borax at present manufactured is exclusively prepared from the native crystals of crude salt, while the mud in which they are found is returned to the lake after the mechanical separation of the crystals by washing. The extraction of the mud is effected by the aid of sheet-iron coffer-dams and a small dredging machine, worked by manual power, but the latter has been very recently put into operation. Until within a few weeks the only apparatus employed consisted of a raft, covered by a shingled roof which has an aperture in its centre about 15 feet square, and above which are hung, by suitable tackle, four iron coffer-dams, six feet by six feet, and nine feet in depth. This raft or barge is moved in parallel lines across the surface of the lake, and at each station the four dams are sunk simultaneously by their own weight into the mud forming the bottom. When they have thus become well imbedded the water is baled out, and the mud removed in buckets to large rectangular washing vats, into which a continuous stream of water is introduced from the lake by means of Chinese pumps—the contents of the cisterns being at the same time constantly agitated by means of rakes. In this way the turbid water continually flows off, and a certain amount of borax is finally collected in the bottom of each tank, which is subsequently recrystallized; but from the density acquired by the washing water, of which no less than 70,000 gallons are daily employed, it is evident that less than one-half of the borax existing in the form of crystals is thus obtained, while that which is present in the mud itself is again returned to the lake.
>
> The dredging machine recently introduced is a decided improvement on the coffer-dams, and may, by the aid of some trifling modifications, be made a very efficient machine; but the mud brought up by it is subjected to the washing process before described, and a small proportion only of the borax is obtained for recrystallization.
>
> CRYSTALLIZATION.—The crystals of rude borax thus daily obtained now amount to about 3,000 pounds, and after being carefully washed they are deposited in boiling water and recrystallized in large lead-lined vessels, from which the purified borax is removed into boxes containing 114 pounds each, for the purpose of being forwarded to San Francisco.
>
> The produce of refined borax now daily obtained appears to vary from 2,500 to 2,800 pounds, which is prepared and packed for the market, as nearly as my data will allow me to calculate, at a cost of about $90 per ton of 2,240 pounds.
>
> CAPABILITIES OF PRODUCTION.—It is evident from the foregoing description that the present system of working is by no means calculated to develop the best results which this property is capable of affording, and that in order to do so it will be necessary to adopt some method for the lixiviation of the mud, its removal from the bottom of the lake, and the crystallization of the borax thus obtained. The total extent of the muddy deposit considerably exceeds three hundred acres, and if we assume that, of this area, only one hundred acres, or that portion now worked for borax crystals, is alone sufficiently rich to pay the expenses of treatment, we shall arrive at the following figures:
>
> One hundred acres are equivalent to 484,000 square yards, and if the mud be worked to the depth of only three and one-half feet, this represents about 565,000 cubic yards; or, allowing a cubic yard to weigh a ton of 2,240 pounds, which is a very low estimate, the total weight of one hundred acres of mud, in its wet state, will be 565,000 tons. If we now assume that the mud extracted from the lake contains 60 per cent. of water, this will correspond to 226,000 tons of dry mud, containing, according to the mean of the analyses of

Professor Oxland and Mr. Moore, 18.29 per cent. of borax; but if, in practice, only 12 per cent. of borax be obtained, this will represent 27,120 tons of crystallized salt.

The present wholesale price of borax in Europe is $320 per ton of 2,240 pounds, and consequently the total value of the amount contained in this portion of the lake would be, on the foregoing assumption, delivered in the market, $8,678,400. If, however, we estimate its value in San Francisco at $275, it is at the port of shipment worth $7,458,000. The expenditure, in plant and appliances, of a further sum of $30,000, would, by the process proposed by Dr. Oxland, allow of a daily production of four tons of borax. This could be produced and delivered in San Francisco at a cost, exclusive of interest on capital and depreciation of plant, of $70 per ton; $1,898,400 for the 27,100, and leaving a difference of $4,559,600 between the expense of production and the market value.

The above calculations are made in accordance with the data furnished by the analyses already quoted of the mud in the central portions of the basin, but exclusive of a consideration of the borax contained in the deposits of other portions of the lake, as well as of the 6,000 tons of this salt, indicated by analyses, as existing in solution in its waters.

A careful consideration of the phenomena attending the production of borax also leads to the belief that its formation is continually going on by the decomposition of carbonate of soda, (which is abundantly contained in the waters of the lake,) by boracic acid emitted from sources beneath its bed, since large quantities of carbonic acid constantly escape from the surface. Should this prove to be the case, it is probable that any moderate extraction of borax may be replaced by the formation constantly taking place.

The quantity of carbonate of soda contained in the mud and water is considerably in excess of the amount of borax present, and could be readily extracted from the mother liquors. Whether this operation could, however, be profitably conducted, with a view to the exportation of soda ash, is a matter of considerable doubt, but the yearly consumption of this substance in California being understood to be about 500 tons, this local demand could, at least, be supplied, at a profit of say 2½ cents per pound—$25,000 per annum.

Sulphur.—Mr. Phillips thus describes the sulphur bank belonging to this company, and the mode and cost of refining the crude sulphur:

Sulphur Bank.—The sulphur bank, which presents the usual characteristics of such formations, is situated on the shore of Clear lake, and covers an area of about 40,000 square yards. In addition to sulphur, small quantities of cinnabar are found in this locality.

The deposit has not, as yet, been extensively developed, but has already afforded 400 tons of refined sulphur, of which about three tons daily can, it is stated, be readily sold in San Francisco at $70 per ton.

From the limited extent of the explorations which have been made, it would be difficult to estimate the probable total yield of sulphur, but it is not unreasonable to anticipate that the bank contains at least from 15,000 to 20,000 tons of that substance.

In order to make immediate returns of sulphur, a refinery has been recently erected for the treatment of the richer portions of the deposit, which frequently do not contain above 10 per cent. of impurity; but there are also vast quantities of tufaceous matters, containing from 5 to 30 per cent. of sulphur, all of which will be ultimately treated with advantage.

The cost of extracting, refining, and delivering a ton of sulphur in San Francisco is now stated to be about $35.

The refinery consists of sundry iron retorts for the purposes of sublimation, together with the necessary condensers and receivers. It is well laid out, and connected with the sulphur bank by a railway 1,300 feet in length.

SECTION XXI.

AGRICULTURAL RESOURCES OF CALIFORNIA.

CALIFORNIA AS A HOME FOR EMIGRANTS.

INQUIRIES FROM LOUISIANA—RESPONSE OF THE EMIGRATION SOCIETY—PUBLIC LANDS, AGRICULTURE, MANUFACTURES, ETC.

New Iberia, Louisiana, *September* 25, 1867.

Sir: Some six weeks or two months ago I presumed to address you, not directing the letter, as is now advised, by Panama. I think it more than probable, on account of Indian disturbances, it will not reach its destination.

In that, the first letter, I made many inquiries in regard to your favored State, and if I repeat them in this, I trust you will not esteem me troublesome. There are several families of us desirous of escaping from the evils that afflict this section, and try our fortunes in States not cursed by negro supremacy. We lost nearly everything by the war, and we wish only protection and health, that we may try to live and educate our children, and where, if we should be so fortunate as to make anything, we would be protected in its enjoyment. With politics we are disgusted, and cannot care again to exercise the privilege of voting, but heartily wishing to be governed by our own race.

To the following inquiries we most respectfully ask answers, and should your time be otherwise employed, we ask that you hand this to some one that will honor us with the solicited information:

1. Are the public lands entirely absorbed?
2. Can they be entered, if public?
3. Are there any special laws regulating the entry?
4. In what part of the State are these lands mostly situated?
5. What is the price of unimproved lands not very close to the city?
6. Of improved places?
7. What are the wages of laborers by day, or month, or year?
8. Is there a demand for labor?
9. Is mining more profitable than farming, or *vice versa?*
10. What section would you advise poor people, desirous of making a living, and, if possible, more, to settle in?
11. At about what price could work-horses, milch cows, &c., be bought in the rural districts?
12. Are goods of all descriptions very much more costly than in New York or New Orleans?
13. Are there any diseases peculiar to the climate?
14. And any information that you may judge would be of interest or service.

Several of us are professional men, but we care not for profession if we can only have a white man's chance to work, and thereby support and educate our families. We would arrive in your city with but little money, and it would be well for us, I suppose, to remain but a short time, and not be very long in locating. At what season would it be best to arrive?

Cotton crop a failure in this State; corn and cane very fine. Yellow fever has been very severe. Permit me again to ask the favor of an early and full answer to the above inquiries.

Yours, respectfully,

THOS. T. FOLSOM.

His Honor the MAYOR *of San Francisco, California.*

REPLY.

Query. "Are the public lands entirely absorbed?"

Answer. No. There are millions of acres yet in the keeping of the federal government officers, which can be had for $1 an acre in gold. Only in the neighborhood of the great thoroughfares, the navigable rivers, the fragments of railways yet constructed, the mining camps and the like, has ever the government surveyor yet erected his theodolite. The whole population of the States of California, Oregon, Nevada, and the Territory of Washington, does not come to a million of souls, and they have more land to live upon than the entire German family of 30 nations and 60,000,000. There are plenty of good spots where small colonies of immigrants may squat upon and await the coming (for years) of the federal government surveyor, and when he shall come, the $1 an acre demanded by the government will have long before been realized out of the land.

In the San Joaquin valley, 60 miles back from Stockton, (a city of about 5,000 inhabitants, and one night's journey by steamer from San Francisco,) plenty of land can be got for $1 in gold per acre from the government office in Stockton. This valley is about 100 miles long, a width varying from 10 to 30 miles, through which streams, navigable for flatboats, flow down to the Sacramento river. The soil is deep and rich, and the bottoms near the water are exceedingly fertile, and able to support abundance of kine. This valley would absorb 100,000 settlers.

We have received from Mr. Merry, of Red Bluff, (a growing town of about 2,000 inhabitants, at the head of navigation on the Sacramento river, and to be reached in two days by steamer from San Francisco, at an expense of from $10 to $12,) an elaborate report of the agricultural and business facilities in that section. He says:

"The slopes of the Sierra hills and coast range, being well watered, afford good pasturage for sheep and horned cattle during the year. The arable land of the country lying along the 'bottoms' of the Sacramento river and its tributaries bear grain crops of from 16 to 40 bushels of wheat to the acre. The best lands in the county (Tehama county) are covered by Mexican grants, to which patent titles from the President of the United States have been obtained. These lands can be purchased from present holders for $10 to $15 per acre. They are adapted to the growth of grain, potatoes and beets. All kinds of vegetables and fruit grow in the greatest luxuriance. Sheep breeding pays well. The flocks in this county number about

100,000 sheep. The quality of wool has a very good name in the San Francisco market, and brings 20 cents a pound. Butter will pay well for skilful dairymen, and cheese also.

"For swine there is no better county in the State. Over 4,000 head of grain-fed hogs have been sold out of the county during the past year. A pork and bacon-packing house in this place is doing an extensive business. The establishment of a woollen-mill here would be the best investment of capital extant. Lumber is cheap, firewood plenty, and water power abundant, going to waste. An iron foundry would pay well here. Money is dear, it brings two per cent., and two and a half per cent. per month. Farm laborers get $30 per month and board. Blacksmiths and wagon makers do well. Some have got rich. Good board can be got for $20 to $25 a month. Cottages can be got for from $8 to $15 a month rent. Town lots for building can be entered at government prices. Common necessaries from the farms are cheaper than in San Francisco. Imported articles are about 30 per cent. higher. As to vine culture it is the best locality for that industry in the State. Here is the celebrated Bosquejo vineyard, where the 'Gerke' wine is made, which is a fair sample of our vine lands. Thousands of acres of equally good lands can be had here for $1 25 an acre."

The section of country referred to by Mr. Merry would absorb and maintain 100,000 persons.

In the counties south of San Francisco—Monterey, for instance—two days' journey by stage from Francisco, large tracts of the richest land, owned by easy-going people of Spanish descent, can be purchased or rented upon very advantageous terms; purchased for $1 or $2 an acre, or rented on shares for one-forth of the annual product of the land. The chief and greatest cost is the cost of fencing.

In many places the old Spanish settlers own tracts of 30,000 to 50,000 acres, unfenced and undivided, over which numberless flocks of sheep and cattle roam and breed and die, without control or much care from the proprietors, who live in rude ease, and almost secluded from the outside world. Their slumbers will soon be broken by the hum of busy immigrants, who will come crowding by sea and land into their fruitful territories. Further south, towards Los Angeles, the best lands can be purchased from those old-fashioned settlers for $1 an acre, or even less. There is very little timber to be cleared from any of these lands,

To go upon these lands, several families should form themselves into villages or companies, and go out together on the land and help each other. This co-operative system is sure to make immigrants happy and prosperous. Farming implements can be got here better and cheaper than in England, or in any of the American cities of the Atlantic. Farm horses can be purchased for $20 to $40 apiece; milk cows, $20 to $30 each. The expense of transporting one person from this city to the government land may be set down at $20. Markets can be found for any quantity of grain, butter, wool, and fruits. The vine is slow in its returns, but quite certain to pay at the end of four or five years, and will yet be the great occupation of Californians. The climate in most parts of California is moderate; in winter there is neither frost nor snow.

The population of California is about 500,000. About 90,000 of these have votes, and are entered on the great register. Being an American citizen, and residing three months in one locality, gives the privilege of voting for all public officers. The voting is done in one day, by ballot, all over the State, and there is no property qualification required in the voter or in the public officer. A person born out of the United States must be two years resident in the United States, have sworn fealty to the American government, and have registered his name on the great register before he can vote.

There are about 50,000 Chinese, and about 10,000 negroes in the State. Neither of them have any political rights allowed them. They cannot vote for any public officer, nor is it likely that ever they will enjoy such privileges. The Chinese are looked upon with much jealousy by the white race. Opposition to them has assumed an organized shape, and there are numerous anti-coolie clubs existing in our city, whose object is to resist and discourage the importation and employment of Chinese labor. About 8,000 Chinamen are employed on the Pacific railway works; about 20,000 are working in and around the mines, and the remainder are scattered over the State engaged in doing the lowest kind of work about the cities and towns; washing, gardening, dealing in fish and vegetables, &c.

Question 2. "Is there a demand for labor?"

Answer. We are anxiously and carefully gathering information from every side, from reliable sources, with the intention of forming a small hand-book for the intending immigrant. We are full of the great idea of inviting an extensive immigration from Europe, and from the southern and eastern States, to the Pacific slope, but we shudder at the thought of misleading any one. It is almost unnecessary to repeat that we have room and work for millions of people in our fields and mines, but the great trouble is to support people while they are finding the work suited to their strength, their habits, and their experience. The idea that fills the minds of many persons in making towards California is, that they shall go a gold-hunting in the mines, make lucky hits, and return at some distant day to their old homes in Europe or the Atlantic States to enjoy their good fortunes. This idea has been the unseen rock that wrecked many an emigrant to this golden land. None should come to the California *mines* but *miners*.

On the first discovery of gold in California, and for several years afterwards, every kind of laborer went into the mines, and many of them did very well; but of late years the Chinese got in, and swarmed over the "placer" or stream mines, and as they work in well organized companies, live upon little, they are able to scrape a living from the oft-washed sands in the older washing grounds of the earlier miners. The principal mining now carried on in California is quartz mining, which is as like coal or iron mining as possible—penetrating the bowels of the earth several hundred feet—men working in gangs, in "watches" of eight hours each shift, so that the work never stops, night or day. For this kind of work miners get $4 a day. Their board and lodging in the neighborhood of those quartz mines comes high, about $8 or $10 a week, as a general rule; two and a half days' wages is required to pay for a miner's board and lodging for a week. A great deal of the work on the Pacific railroad on our side of the Rocky mountains is performed by Chinamen, under white overseers. They get about $1 a day for their labor. White men could get that wages and board, but they won't work for it. A dollar a day is the lowest notch which the strong man's labor has touched in any part of California. Common labor, according to skill, ranges up to $1 50 and $2 a day. We are not now talking of skilled mechanical labor, such as carpenters, bricklayers, plasterers, smiths, machinists, foundry men, tailors, shoemakers, and the like. The labor of these sort brings $3 to $5 a day in all the cities and in all the towns of the Pacific coast. As to clerks and light porters, and those who are always waiting for an easy berth or something to "turn up," there is little encouragement for them. The cities are full of them. This sort of helpless people are the production of an erroneous system of education, which has weaned the boy from labor, and left the man a helpless, pitiable mendicant.

You are, doubtless, impatient to learn, then, what sort of people are likely to do well here, and we answer, any sort who are thoroughly determined to work—men and women, young and old.

The lowest wages for labor among us is about twice the wages of New York, and four times the wages obtained in Great Britain, Ireland, or Germany. The price of wheaten flour is about one-half what it is in Liverpool or New York—$8 a barrel of 196 pounds just now. Tea, sugar, and coffee about the same as in England or New York. Clothing and house rent about double the English rates, and about the same as in New York. All the foregoing rates are in gold.

Question 3. "Is mining more profitable than farming?"

Answer. This question is one still more difficult to answer. Farming has lately acquired a fixed character. The fine qualities of wheat and flour which California yields—the vast quantities of wool, of butter, of fruit and wine, and the high prices these products realize in New York and Liverpool, have latterly decided great numbers of our population to go into farming. One only drawback which farming in California will ever experience, and that will occasionally arise from long seasons of drought.

The last three years the seasons were very well mixed with rains about the time they were wanted, and sunshine when wanted; and our farmers have had splendid crops and obtained high prices. About four years ago there was a long drought and a cattle famine was experienced. Flour ran up to very high rates, and there was much suffering among the working people. This has passed away and is forgotten in our present prosperity, but it is well for all immigrants facing to this country to be made aware of these things.

We have, in general, about seven months of the year when there does not fall a drop of rain, yet vegetation is nourished by copious dews. Then we have four or five months when it pours down plenteously, and this rain it is that brings us the means to obtain the food that lies intact in the earth, and enables our miners to wash the clay and sand that contains the gold dust.

The total produce of our gold and silver mines may be set at $50,000,000 to $60,000,000 a year. Our farming and general agricultural products will very soon, if they do not now, foot up to $50,000,000 worth a year. The value of the wheat and flour shipped from California since last harvest comes up to $9,000,000; and as fast as good ships come into the harbor they are engaged to take out wheat and flour, wool, hides, &c. The general demand for all sorts of mechanics in this city, and throughout the State, was never better. The wages, as we have said, range: For Chinamen, $1 a day; common laborers, $2 a day; skilled mechanics $3 to $4 a day—some of superior skill, $5 a day; female servants, $15 to $25 a month, and board; farm laborers, $30 a month, and board. All these prices are gold, and all our dealings here are managed on a gold basis.

Question 4. "Are there any diseases peculiar to California?"

Answer. The climate of California is the most healthful to be found in the world. It is equable all the year round. The thermometer ranges from 50° to 90° throughout the State. We lay from 32° to 42° north latitude. We have neither frost nor snow, except on the high mountains of the Sierra Nevada, and some of the mountains in the Coast range. The only drawback to health is experienced in the neighborhood of the mines, where the water is overstrongly impregnated with mineral matter, which generates ague and peculiar fevers; but in the agricultural regions the people live on from year to year their whole lives without experiencing a day's sickness, and the children multiply in numbers and develop in symmetry and beauty beyond those of any race on the face of the globe.

Next to the employments under the head of "ordinary agriculture" is the vine culture, which is peculiar to California; its vines and wines are now celebrated all over the world.

But a few years ago it was not supposed the vine would flourish anywhere but in the southern region and Los Angeles. Latterly, experiments have demonstrated that it will flourish in the acclivities around the mining camp as well as amid the sheep-walks and pastoral plains and valleys; that whether it is pressed into wine or distilled into brandy, it will reward the labor bestowed upon its cultivation. The California wines begin to make their way in the New York market, and each new year will confer on their quality more richness and more reputation.

The grape vines of California, when five years old, yield plenteously; one has only to own half dozen acres, well planted with vines of that age, to realize a life-long *indepedence*. In a few years from the present time, the wine and silk of California will form some of the leading articles of its export.

The fruits of California are now so rich and plentiful that the farmers begin to dry, and press, and ship them to the Atlantic cities, from whence, but a very few years ago, we imported dried fruits, flour, &c.

The raising of the silk-worm has been commenced in California, and has succeeded. It is proven that the climate is quite as favorable as that of France or Italy for this branch of industry. Arrangements are in progress to start a silk factory. The success of this experiment will lead to national results by and by. We shall soon come to the raising of tobacco, beet root, and manufacture of beet and cane sugar, cotton, flax, linen, hemp, and hops, for all of which the soil and climate are admirably fitted. Some cotton has been raised in the southern parts of the State in a desultory way, but the soil awaits the enterprising hands of toiling men to bring about those great results from the vast and varied material that sleeps neglected in the soil, and hovers over us in the overhanging climate.

We are building small coasting schooners of 50 to 200 tons. All those craft are well employed in carrying lumber, coal, and the produce of the fields into market, and latterly groups of those small craft have gone fishing for cod in the North Pacific with great success. The salmon and other fish caught in our waters are certainly the best in the world.

Our progress in manufacture is infantine and rude. Three or four woollen mills and one cotton factory are all that California can boast of, but these are doing well, and in good time others will start. Our tanneries are numerous in city and country, and their manufactures well liked and in good demand. We should say the business is healthy, with fair profits. Soap and candle factories are experimenting on the native tallow and beeswax of the country —this is the land for bees and honey.

They have begun one factory for making boots and shoes, and so far it is prosperous, employing two hundred hands. There is room here for many paper and flour mills. We have two glass factories, on a small scale, doing well, and any number of iron foundries, all at full work. There has been a glove factory lately started, and is doing well; also a rude pottery-ware factory. We want half a dozen hat factories, in which the hat from the foundation would be made, trimmed and finished. We have plenty of printers and an abundance of newspapers. The population of San Francisco is about 120,000. We have eight morning and evening newspapers, and 12 or 15 weeklies. We have a score of banks, 15 insurance companies, any number of hotels, boarding houses, and public schools. About half the population are native-born Americans from the Atlantic States; the other half is divided among the Germans, Irish, French, Spanish, Chinese, and negroes. The Jews have two synagogues, the Roman Catholics eight churches, and the Protestants a dozen or so. Take them as a whole, they are the most hospitable and generous crowd of citizens to be found in any seaport round the whole earth. No man nor woman will be suffered to want food here, and no industrious man nor woman need be afraid of casting their destiny in the fertile grazing lands of California.

We hope these few hints on our new and growing State will be useful. The worst time for travelling through our interior districts are the winter and spring months, when the roads are softened by the rains. Rains usually begin in December and continue down to April.

We remain, respectfully,

H. A. COBB, *President.*
THOMAS MOONEY, *Vice President.*
J. W. McKENZIE, *Secretary.*

SAN FRANCISCO, *October* 29, 1867.

Tabular statement of receipts and exports of agricultural products at San Francisco, California, from June, 1860, *to July,* 1867.

RECEIPTS.

Year.	Flour.	Wheat.	Barley.	Oats.	Wool.
	barrels.	100-*lb. sacks.*	100-*lb. sacks*	100-*lb. sacks.*	*Pounds.*
1861	122,809	2,164,320	671,414	305,208	3,721,998
1862	111,269	1,451,465	612,014	343,808	5,990,300
1863	149,825	1,890,777	435,945	172,896	6,268,480
1864	99,298	1,843,840	623,266	304,504	7,435,670
1865	61,670	509,163	415,914	255,839	8,889,931
1866	167,316	2,138,442	984,208	322,528	7,851,629
1867	301,449	5,214,196	767,938	326,119	*7,166,680
Totals	1,013,636	15,212,203	4,510,699	2,030,902	47,334,688

* To August 1.

EXPORTS.

Year.	Flour.	Wheat.	Barley.	Oats.	Wool.
	Barrels.	100-*lb. sacks.*	100-*lb. sacks.*	100-*lb. sacks.*	*Pounds.*
1861	197,181	1,529,924	339,537	116,462	3,721,998
1862	191,652	851,844	188,619	154,587	5,990,300
1863	144,882	1,043,652	49,809	39,985	5,268,480
1864	152,633	1,071,292	40,260	91,082	5,935,670
1865	91,479	25,360	13,920	3,389	6,549,931
1866	279,554	1,039,518	349,991	113,961	4,662,129
1867	485,337	3,636,194	142,157	88,331	2,104,000
Totals	1,452,718	9,197,784	1,124,296	607,797	34,232,508

Countries to which exported during the year 1867.

Destination.	Flour.	Wheat.	Barley.	Oats.	Wool.
	Barrels.	100-*lb. sacks.*	100-*lb. sacks.*	100-*lb. sacks.*	*Pounds.*
New York	201,478	510,784	27,625	....	2,758,000
Great Britain	38,921	3,131,553	2,797	83	....
China	69,270	151,124	1,700	3,544	....
Japan	1,410	544	28,579	2,700	....
Hawaiian Islands	4,171	366	1,763	2,487	....
British Columbia	1,676	2,950	7,788	565	....
Mexico	3,149	10	2,130	187	....
Australia	1,650	172,069	70,892	1,281	....
Rio de Janeiro	22,669	....	....	....	....
Other countries	40,732	58,546	1,223	196	....
Totals	385,126	4,027,946	143,497	11,043	2,758,000

SAN FRANCISCO IN 1867-'68.[*]

The total population of the city, August 1, 1867, is estimated at 131,100. The estimate for 1858 was 83,223, showing an increase in eight years of 47,877. The particulars of the estimate for 1867 are as follows:

White males over 21, names in the present volume	45,000
White females over 18, estimated	27,000
White males under 21 and females under 18, estimated	40,000
White males, names refused, and foreigners, estimated	4,000
Chinese, male and female	3,600
Colored, male and female	2,500
Total permanent population	122,100
To which should be added a large element of our population known as "floating," which consists of: 1st. Transient boarders, &c., at hotels, boarding-houses, &c. 2d. Soldiers at the fortifications in the harbor. 3d. Persons engaged in navigating the bay, who claim the city as their residence. 4th. A large number of persons who have no permanent place of abode, together amounting to about	9,000
Total population	131,100

The school census of July, 1867, gives the number of children under 15 years at 34,710. The number of males between 15 and 21, and females between 15 and 18, is estimated at 5,290, making the aggregate 40,000 of all ages.

IMPROVEMENTS OF THE YEAR PAST.—The number of buildings erected in San Francisco during the year ending June 30, 1867, is 1,050, of which 340 are of brick; total in the city and county, 17,368, of which 3,857 are of brick. The estimated cost of the improvements during the same period is nearly $9,000,000. The sales of real estate for the first seven months of the present year exceed $10,000,000. The operations of the department of streets and highways, for the year ending June 30, 1867, show an expenditure exceeding $1,000,000.

The cost of a number of the principal new buildings is thus given: Bank of California, $275,000; Mercantile Library, $110,000; Merchants' Exchange, $190,000; Fireman's Fund Insurance, $45,000; Pacific Insurance, $80,000; Merchants' Mutual Insurance, $60,000; Hibernia Savings and Loan, $65,000; Murphy, Grant & Co.'s four-story iron-fronted brick block, $170,000; enlargement and improvements Lick House, $175,000; Dr. Scudder's church, $64,000; Trinity church, $75,000; St. Joseph's, Catholic, $18,000; Tehema street school-house, $26,000; almshouse, $60,000; Oriental buildings, $200,000; additions to Occidental Hotel, $125,000; Blanding & Pringle's block, $70,000; Ellis's block, $65,000; Brannan's new building, $60,000; Savings Union building, $50,000; Hayward's building, corner California and Leidesdorff, $90,000; Morrow's building, California, near Montgomery, $50,000; Tucker's building, $45,000.

STREETS AND SEWERS.—The total expenditure in the department of streets and highways for the year ending June 30, 1867, amounts to $1,009,883 85, viz: For grading 1,191,257 cubic yards, at a cost of $327,333: paving 166,083 square feet cobble-stone and 236,005 square feet Nicholson, together, $117,594; brick sewers, 21,203 lineal feet, $156,745; planking, 2,571,083 feet, $96,897; sidewalks, 69,925 front feet, $96,154; cross walks, 6,296 feet, and curbs, 19,193 feet, together, $47,423; macadamizing, 1,560,119 square feet, $117,272; redwood sewers, 12,137 feet, $49,578. The entire cost of street work from July 1, 1856, to June 30, 1867, is $5,439,287. The total length of sewers constructed from July 1, 1856, to June 30, 1867, is 165,583 lineal feet, or nearly 30 miles of sewerage. The principal improvements have been the grading of McAlister street, from Larkin to Fillmore; Tenth street, from Market to Howard: Townsend street, between Third and Fourth; Brannan street, between Second and Third; Fillmore street, from Sacramento to Pacific; Clay street, from Jones to Leavenworth; O'Farrell street, from Larkin to Polk; California street, from Polk to Franklin; Fulton street, from Buchanan to Fillmore; Van Ness avenue. from Bush to Geary; Franklin street, from Ellis to Turk; Main street, from Mission to Folsom; Fourth street, between Brannan and Townsend; Taylor street, between Broadway and Vallejo; Spear street, from Harrison to Folsom, and Bush street, from Larkin to Cemetery avenue.

WATER FRONT IMPROVEMENTS.—The work of constructing a sea wall for the protection of the city front and better accommodation of shipping has been commenced during the past year. It will be 8,336 feet in length when completed. It is estimated to cost $2,462,470, or $295 37½ per linear foot. It is to be constructed of solid granite, eight feet thick at base and six feet at top, resting on a broad embankment of rocks and cement.

The new dry dock, nearly completed, at Hunter's Point, about four miles southeast from Folsom street wharf, is one of the most important enterprises ever undertaken by private citizens. This work was commenced in September, 1866, and is expected to be completed by the close of the present year. The dimensions of the dock are 465 feet long by 125 feet wide on the surface, and 400 feet long by 80 feet wide on the bottom, and of sufficient depth to permit vessels drawing 22 feet of water to float in it. Nearly the whole of this great excavation has been cut out of solid rock. The materials extracted have been sufficient to cover 10 50-vara lots of the adjoining swamp land to a depth to bring them up to the grade of the city. The whole front of the dock will be covered with solid blocks of cut granite, 13,000 square yards of which have been brought from the quarries at Rocklin, Sacramento county, for that purpose. Powerful engines, pumps, and every necessary arrangement for rendering the works complete have been constructed, the whole cost of which will exceed $1,200,000.

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[*] Compiled from Langley's City Directory.

The Merchants' Dry Dock Company have completed a floating apparatus, calculated to sustain vessels of 1,000 tons burden. This dock cost $60,000.

The Union Lumber Association are constructing a dock near Beale street, which is estimated to cost $150,000. This association has expended $185,000 in the construction of wharves and other improvements on lands adjoining the new wharf of the Pacific Mail Steamship Company. The improvements made and in progress under the direction of this latter company have quite changed the topography of the western front of the city. This company owns the block of overflowed land bounded by First, Second, Townsend, and Brannan streets, about 12 50-vara lots. They have constructed wharves, which have required 1,200 piles, 3,000,000 feet of sawed lumber, 35 tons of iron bolts, and 300,000 cubic yards of earth to complete. They erected a two-story brick warehouse, 195 feet deep by 230 feet wide, cut down hills and filled up swamps to such an extent that what had been the most useless portion of the city front has become the centre of an extensive business. Hundreds of men and teams are at present engaged cutting down the hills in the vicinity and filling up the shallow bay with the materials, extending the area of the city hundreds of feet over what had been useless territory. The erection of several large warehouses is contemplated in the vicinity.

Markets and Rolling Mills.—The new California Market, extending from California to Pine streets, was commenced and has been completed during the past year. This is one of the most useful improvements in the city, being centrally located and most conveniently arranged. It is a most substantial structure, with elegant iron fronts on each of these streets, resting on a solid cut-granite basement. It cost about $200,000. Another extensive market, which cost about $60,000, has been built on Howard street, between Third and Fourth.

Among the new branches of manufacture introduced during the past year the Pacific Rolling Mills holds a prominent position. It is located at Potrero Point, and has been fitted up with every requisite for manufacturing iron bars and rods of any shape or form, from a ¼ inch up to 36 inches in diameter, including railroad iron of all descriptions. These works cost $1,000,000.

Real Estate.—Statistics in the office of the city and county assessor place the value of our real estate improvements for the past fiscal year at $58,000,000. The number of sales of property made for the 12 months ending July 31, 1867, was 5,213, at a valuation of $15,383,196. The above figures include only the sales recorded. The prices paid at the Beidman sale would swell the total to nearly $16,000,000.

Educational Facts.—There are 34,710 white children under 15 years of age in the city. Our juvenile population has increased nearly 300 per cent. in seven years. The average number of pupils belonging to the public schools June 30, 1867, was nearly 11,000. Eight new school-houses were erected during the year. The disbursements of the school department of the public school fund upon the assessment roll of the last fiscal year were $320,958 88—slightly within the receipts. Basing the amount of taxes for the benefit $80,000,000, at the school tax rate of 35 cents on each $100, the amount raised from this source the present year will be $280,000; apportionment of the State school fund, $60,000; poll taxes, $2,500: dog tax, $1,000; rent of school property, $600; evening schools, $200. Total revenue for the present year, $344,300.

The whole number of private educational institutions in San Francisco is about 70, with an aggregate attendance, including students at the different colleges, of 4,250. Of this number 12 are under the control of the Catholic denomination, and the regular aggregate attendance upon the same is over 3,400.

There are 21 schools connected with the Protestant Sunday School Union. The average attendance at these schools is 4,340; other Protestant schools, 2,405; Catholic schools, 3,600; Hebrew, 690. Total who receive religious instructions on the Sabbath day in this city, 11,035. Libraries--number of volumes Sabbath School Union, 19,927; other Protestant schools, 12,000; Catholic schools, 6,000. Total number of volumes in Sabbath schools in this city, (Hebrew not included,) 37,927.

New Manufactures.—Among the most prominent of the branches of industry put in operation are the Pacific Woollen Mills, located at the Mission, manufacturing knit goods of all descriptions at the rate of $500,000 annually, and employing nearly 400 persons; the Golden City Chemical Works, with a capital of $2,000,000, and manufacturing a great variety of chemicals and medicinal extracts; the San Francisco Glass Works, manufacturing both white and colored glassware to the extent of $150,000 a year, and the San Francisco Linseed Oil and Paint Works, with capacity to supply the entire wants of the coast. These, with minor enterprises inaugurated during the same period, have absorbed more than $3,000,000 capital, and will turn out manufactures to half that amount annually. The most prominent of the enterprises yet unfinished is the Pacific Rolling Mills, which promises to be in successful operation within the next twelve months. This establishment is much needed, both to do away with the importation of a vast amount of manufactured metals and to stimulate new branches of labor by furnishing supplies of home materials which are required to make them successful. The large capital of these mills, and their contemplated extensive scope of manufacture in copper as well as in iron, promise to do more to develop the resources of the State in these metals than all similar enterprises now in operation combined.

GENERAL MANUFACTURING ITEMS.—The pecuniary results of all the manufacturing interests in this city for the past year are favorably reported. The sugar and petroleum factories are alone complained of as being less successful than in former years. The Pioneer and Mission Woollen Mills manufactured for the year ending June, 1866, goods to the value of $899,734. The Mission mills alone turned out, with 425 hands, 80,000 pairs of blankets, 125,000 yards of broadcloth and cassimere, 500,000 yards of flannel and cloaking, besides a quantity of shawls; the whole consuming 2,000,000 of wool. The Pacific Woollen Mills will make up into knit woollen goods this year 500,000 pounds of fine wool. Mayer & Sons' cotton wadding, batting, and twine works can turn out 2,000 pounds of wadding and batting per day. The cotton they use is imported chiefly from Tahiti and Mexican ports. The Pacific Cordage Factory turned out last year 2,000,000 pounds of cordage. The rope-walk is 1,500 feet long, and the works altogether employ 47 men constantly. The Pioneer Woollen Mills, during last year, employed 350 hands, and made 30,000 pairs of blankets, 60,000 yards of broadcloths, tweeds, and cassimeres, and 375,000 yards of flannels, which consumed 1,300,000 pounds of choice wool. A very large portion of the flannels manufactured is made up at once into shirts, the company employing 60 sewing machines in that and other work connected with their manufactures.

There are three manufactories of acids and other chemicals in the city, which supply the assay offices and mint on this coast. The Phœnix Oil Works have a refining capacity of 400 gallons per day. Mallon & Co.'s glass-cutting works manufactured to the amount of $6,000 in 1866. The Pacific Saw Works turned out manufactures valued at over $3,000,000. Dana's neat-foot oil works turned out 33,997 pounds of glue and 5,007 gallons of oil. Cameron, Whittier & Co. made mirrors to the value of $18,000. Zech made 12 pianos last year, of an average value of $450, using native ash, laurel, and other domestic woods. John Mayer made two large organs of good quality. The glass manufactures of the year aggregated $80,000.

There are 11 extensive flour mills in the city, which exported the first eight months of this year 136,958 barrels of flour via the Isthmus of Panama. Eight mills turned out last year an aggregate of 247,708 barrels, besides large quantities of other meals. Eight saw-mills turned out 8,950,000 feet of lumber.

Up to the present time the principal foundries and machine shops located in this city have turned out machinery for the propulsion of 1,000 ton vessels, stationery engines, batteries of heavy guns, the most powerful quartz-crushing machinery, saw and flour mills, and for a multiplicity of business not needed to mention. With the exception of the raw materials used for castings and machinery, the foundries of the State have rendered its people independent of other countries and given profitable employment, directly and indirectly, to several thousands of persons. At the present time there are 14 large foundries and machine shops, some of which have no superiors anywhere in excellence of work and adaptation of materials to meet the wants of the people. During the year 1866 these foundries, with some few smaller ones, employed 1,018 men, using 6,921 tons pig iron, 1,448 tons bar and rod iron, 1,027 tons sheet and boiler iron, and 110 tons rivets. Several of these establishments have extensive boiler shops connected with them.

The three sugar refineries in this city have a capacity nearly double the local consumption. One establishment alone has a capacity to refine 120,000 pounds daily. Altogether about 300 men are employed in these refineries. Twenty thousand boxes of maccaroni and paste were made by one firm last year. Another house made 3,000 gross of yeast powders. About 24,000 brooms were manufactured. Wooden ware and box manufacturing is extensive and profitable. The new linseed oil works can crush 4,000 pounds seed per week. Two firms have made 5,000 billiard tables in this city in 16 years. During 1866 they employed 12 men and made 70 tables, worth $480 each.

The products of several other manufactories may thus be condensed: Ten soap establishments, 2,831,419 pounds; three match factories, 250,000 gross; five tanneries, 2,400 hides, 615 dozen calf and 515 kip skins; hose and belting, 6,000 feet hose, $7,000 worth of belting, and 400 dozen horse collars; boots and shoes, total manufactures, $750,000, employing about 500 men; type foundry at the rate of $20,000 per annum; 24 breweries, of which 17 turned out 76,602 barrels of beer; furniture establishments employ over 300 men and turned out about $800,000 worth of furniture; 800 cigar makers, employed by 100 firms, turn out nearly 3,000,000 cigars a month; the clothing manufacturers employ 700 persons and turned out last year $1,500,000 worth of goods; 20 firms are engaged in making carriages and wagons.

TRADE FLUCTUATIONS.—A general table of the fluctuations of trade shows that the number of persons in business in this city has increased from 5,300 in 1862 to 6,942 in 1867. Only the leading branches of trade are included in this table. Of those in business in 1862 only 3,956 are still found in existing trade circles. The yearly changes among small dealers will not fall short of 40 per cent. per annum.

MUNICIPAL FINANCES.—The total assessment for 1866–'67 is $96,700,397. Of this valuation $53,485,421 is assigned to real estate, and $43,214,976 to personal property. The total of State, city, and county taxes is $3 10 on each $100. The amount absolutely collected on is much less than the aggregate valuations for the last two years. In 1865–'66 it was $22,730,719 personal against $39,775,500 assessed, and $45,436,924 real estate against $49,138,027 assessed; in all, $68,167,643 collected on against $88,913,527 assessed.

The city expenditures for 1865–'66 were $1,437,281 20, which amount was divided as follows: Current expenses, $916,934 45; permanent improvements, $90,995 90; interest, $256,198 38; reduction of debt, $154,055; old claims, $19,097 47. The expenditures for 1866–'67 are thus stated: Current expenses, $939,285 05; permanent improvements, $188,073 75; interest, $213,353 06; reduction of debt, $354,686 82; old claims, $71,166 66: total, $1,766,565 34. Increase this year, $329,284 14.

The total revenue for 1865–'66 was $1,624,408 06. That for 1866–'67 was $1,841,753 96, showing an increase of $217,345 90. The revenue is derived this year as follows: Taxes, $1,482,476 31; State and county licenses, $93,901 50; municipal licenses, $31,762 50; sale of bonds, $125,965 38; other sources, $107,647 97.

The bonded debt aggregates $4,748,667, bearing interest at from 6 to 10 per cent. The annual sinking fund is about $198,500. The bonds in aid of the Pacific railroad alone amount to $650,000, bearing 7 per cent. interest.

CLIMATE OF CALIFORNIA.—The following interesting and instructive observations on the climate of California are from the proof-sheets of a forthcoming work on the Pacific Coast, by Mr. T. F. Cronise, soon to be issued by Messrs. H. H. Bancroft & Co., of San Francisco:

THE VARIETY OF CLIMATE.—There are essentially two climates in California, the land climate and the sea climate. The latter derives its low temperature from the ocean, the water of which along the coast stands at from 52° to 45° all the year round. The evenness of the ocean temperature is owing to a steady current from the north, which is accompanied also by winds in the same direction during the entire summer season, or rather from April to October, inclusive. Almost daily during this period a deluge of cold, damp air, of the same temperature as the ocean over which it has passed, is poured upon the land. It is mostly laden with mist, in dense clouds, which it deposits at the foot hills and on the slopes of the highlands, or carries a short distance into the interior, wherever there is a break in the land wall.

The land climate is as nearly as possible the opposite in every respect. In summer and atuumn it is hot and dry. It undergoes various modifications from the configuration of the surface of the earth. Even the mountains, which retain the snow till a late period, present a high temperature in the middle of the day, and the presence of the snow on their summits in June is owing to the great mass which has accumulated on them rather than to cold weather.

A large district of territory lies between the jurisdiction of the two climates, and subject to their joint influence. It is composed chiefly of valleys surrounding the bay of San Francisco, and penetrating into the interior in every direction. There is no climate in the world more delightful than these valleys enjoy, and no territory more productive. While the ocean prevents the contiguous land from being scorched in summer, it also prevents it from being frozen in winter. Hence ice and snow are not common in the ocean climate. The difference in temperature is comparatively slight between winter and summer.

The cold of winter in the interior is not intense, even on mountain elevations, with the exception of the tier of counties in the extreme north. Its degree depends much, however, on the altitude of the locality. The severity of winter is due, not to extreme cold in any part of California, but to violent and prolonged snow-storms in one section, and cold and prolonged rains in the others.

It is interesting to cast the eye over the map of the State, and trace out climatic modifications as governed by topography. First, look at the long range of coast, the slope of which, as far back as the first mountan wall, is under the control of the ocean, and has the most uniform of climates. It is a narrow strip of territory, the only part of the State preserved from dessication in summer by daily showers of mist, and therefore admirably adapted to dairy purposes. Then survey the counties bordering on the great bay, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo, borrowing one-half their climate from the ocean, and the other half from the interior; inexhaustible in agricultural resources, and forming the granary of the Pacific. The Pajaro and some other valleys further south, to which the sea winds gain access, belong to the same system, and those also of the Sacramento and San Joaquin, although in a lesser degree, being further removed from the ocean. Then regard the mountain range, with its countless little valleys, buried up with snow in winter, bursting forth into a paradise with the spring, and converted into furnaces by the summer's sun, and yet luxuriant with all kinds of delicious fruits. In this section are concentrated the mining interests. Finally, view the southern section, embracing one-fourth of the State, removed alike from both extremes, which operate in the north, controlled neither by mountain nor ocean, and enjoying the most genial temperature—a section of country wanting only in the certainty of winter rains to make it an Eden.

Climate of San Francisco.—The record of the climate of San Francisco, as kept by Mr. Henry Gibbons, extending from the autumn of 1850 to January, 1868, a period of 17 years, shows the coldest weather during that time to have occurred in January, 1854, when the mercury fell as low as 25°. The coldest noonday for the same period was 37°. Persons who do not rise early may see no ice in that city for several years in succession. When it is cold enough to preserve ice in the shade all day, the circumstance is noted as a phenomenon. It is not uncommon for the entire winter to pass away without bringing the thermometer down so low as the point of freezing. In the year 1853, it fell at no time lower than 40°, or 8° above the freezing point.

The extreme of heat in the same period occurred on September 10 and 11, 1852, when the thermometer reached 97° and 98° on the two days respectively. This, however, was entirely exceptional, and might not again occur in half a century. The air was dry as a sirocco, and had a curious effect on the wood-work of houses, causing a constant crackling noise, from the shrinking of the timber and the plaster breaking on the wooden partitions. In a locality somewhat exposed to reflected heat from the sun, and where the temperature was 100°, a thermometer with a wet bulb fell to 68°, the evaporation reducing it 32°.

With the exception just noted, the hottest day in the 17 years was on the 6th of July, 1867, when the thermometer stood at 93°. In October, 1854, and in September, 1865, it reached 91°; and in July, 1855, it rose once to 90°. Thus, it appears there were but six days in 17 years when the temperature was as high as 90°, and only two of these six days were in the summer months.

The absence of warm weather in the summer months is characteristic of the coast climate, and strikes a stranger forcibly. The most ordinary programme of this climate for the year is as follows, beginning with the rainy season: The first decided rains are in November or December, when the country, after having been parched with drought, puts on the garb of spring. In January the rains abate, and vegetation advances slowly, with occasional slight frosts. February is spring like, with but little rain. March and April are pleasant and showery, with an occasional hot day. In May the sea breeze begins, but does not give much annoyance. In June, just as warm weather is about to set in, the sea breeze comes daily, and keeps down the temperature. It continues through July and August, occasionally holding up for a day or two, and permitting the sun to heat the air to the sweating point. In September the sea wind moderates, and there is a slight taste of summer, which is prolonged into the next month. The pleasant weather often lingers in the lap of winter, and is interrupted only by the rains of November or December.

By running the eye over the following table, a general idea can be gained of the coast climate as regards temperature. The first column represents the average temperature of each month at sunrise, for 17 years; the second at noon, and the third is the mean of the other two:

Months.	Mean at sunrise.	Mean at noon.	Monthly mean.	Months.	Mean at sunrise.	Mean at noon.	Monthly mean.
	°	°	°		°	°	°
January	44.	56.	50.	August	53.	67.	60.
February	48.	60.	53.5	September	53.5	69.5	61.
March	48.	63.	55.5	October	53.	68.	60.5
April	49.	64.	57.	November	49.	62.	55.5
May	50.	64.	57.	December	45.	55.	50.
June	51.	68.	59.5				
July	52.	67.	59.5		49.5	63.7	56.6

Observe in the table the regular increase from January to September, and the rapid decrease from October to December; nine months of increase and two of decrease. Notice, also, the uniform increase of the night temperature as represented in the first column, and the irregularity in the noonday increase, the sea-breeze arresting it in May, and the sun giving it an upward impulse in June, before the sea wind has gained undisputed control.

Mean Annual Temperature.—The mean annual temperature at San Francisco is 56.6, which may be set down as the mean of the coast and bay climate. As we recede from the ocean, the days are warmer and the nights colder, the sun being the great disturber of temperature, and the ocean the great equalizer. But the increase of the day corresponds so nearly with the diminution of the high temperature, that the mean varies but little within the range of the sea breeze.

Washington and Richmond, nearly in the same latitude as San Francisco, have a mean of 54 or 54½, two degrees colder than the latter. This appears, at first sight, to be a small difference; but its value is made evident by reflecting that it is a difference for every day in the year—each day of the year in San Francisco, from January to December, having an average of two degrees higher than the corresponding day on the Atlantic border. Cold as our summers are in proportion to those in the east, it appears that the winters are warmer, in still greater proportion.

In the Atlantic States the mean annual temperature diminishes in going northward about one degree for every degree of latitude. This is the general rule in all climates. But the climate of California presents an extraordinary anomaly in this respect. Along the coast, from the mouth of the Columbia river to Monterey, a range of nine degrees of latitude, the mean temperature varies but little—not more than three or four degrees at most; and even this difference does not correspond exactly with the difference of latitude. On the other hand, the interior climate varies indefinitely, every valley having a climate of its own. The summers, however, are generally hotter in the north. One might start from Los Angeles, near the south line of the State, in summer, and travel northward, inland, 500 or 600 miles, and find it growing hotter every day; and he might go in a southeasterly course less than half that distance, and arriving at Fort Yuma, on the Colorado, he would find one of the hottest places in the world.

The sudden fluctuations of temperature, incident to the climate of the Atlantic States, are unknown in California. We have none of those angry outbreaks from the northwest, which change summer to winter in a few hours. The sea breeze is chilling enough, especially when it comes in suddenly to reassert its sway, after one of the occasional warm days of summer. But the sea breeze can never bring the thermometer down below 52°.

In the summer months there is scarcely any fall of temperature through the night in the coast climate. The early morning is sometimes clear, sometimes cloudy, but always calm. A windy morning in summer is uncommon at San Francisco. A few hours after sunrise the clouds break away and vanish, and the sun shines forth cheerfully and delightfully; not a breath of air stirring. Towards noon, or a little after, the sea breeze sets in, and the weather is completely changed. From 65° degrees the mercury drops to 53° or 54° long before sunset, and at that point it remains almost motionless till the next morning. This is the order of things in three days out of four in June, July, and August.

In the climate of the coast the nights are never uncomfortably warm. The extreme heat at 10 p. m. at San Francisco, for 17 years, was 75°. The thermometer reached this point on three different nights; on two nights it reached 75°, on four nights 73°, on two nights 72°, and on five nights 70°—making only 16 evenings in 17 years when it was warm enough at bed-time to sit out of doors with thin clothing. The warmest morning in 17 years was 69°. These facts have special interest in relation to sleep.

Though the nights in the interior are not so uniformly cool, yet there are few localities, even in the valleys, where they are too warm for sleeping, even though the day temperature may have reached 100°. This is a remarkable feature of the climate of the Pacific States, and it has an important bearing on the health, vigor, and character of the population.

In the southeastern corner of the State is a section having a climate of its own. It is known as the Colorado desert, and is comparatively barren of vegetation, owing to the small quantity of rain which falls there. The mean temperature of Fort Yuma, though not exactly in the desert, is, in the month of July, upwards of 100° at noon, and 90° at 9 p. m. In contrast with this, is the winter climate of Yreka, near the extreme northwest corner of the State, and representing a small alpine section bordering on Oregon. During the stormy weather of January, 1868, when the thermometer at Marysville and other localities in the north were telegraphed as ranging from 25° to 35°, at 8 a. m., the despatches from Yreka placed it below zero day after day, and sometimes 10° or 12° below.

We will conclude the subject of temperature with a table, representing the mean of the several seasons at a number of prominent points in California, and also further northward. The first column gives the temperature of the spring months, March, April, and May; and so on, the other seasons are arranged. The last column is the mean annual temperature.

Localities.	Spring.	Summer.	Autumn.	Winter.	Year.
	°	°	°	°	°
San Francisco	56.5	60.0	59.0	51.0	56.6
Sacramento	56.0	6.50	61.0	46.5	58.0
Benicia	56.5	67.0	60.5	49.0	56.0
Monterey*	54.0	59.0	57.0	51.0	55.5
San Diego	60.0	71.0	64.5	52.5	62.0
Fort Yuma	72.0	90.0	75.5	57.0	73.5
Humboldt Bay*	52.0	57.5	51.0	43.5	51.5
Port Orford	52.0	61.0	55.0	47.5	53.5
Dalles, Oregon	53.0	70.5	52.0	35.5	53.0
Astoria	51.0	61.5	54.0	42.5	58.0
Fort Steilacoom, W. T	49.0	62.0	51.5	38.5	51.0

* The figures for these localities are probably too low.

There is this difference between the summer in the interior of California and the Atlantic States, that in the former it is unbroken by the showers and storms which in other regions temper the heat and give variety to the climate. From the beginning of June until November the sky is mostly unclouded, and the sun shines out brightly the whole day.

THE ANNUAL RAINS.—In the entire absence of rain during one portion of the year, and its restriction to another portion, California has but one climate. There is this difference, however, between one part and another, that the rain commences sooner and continues later in the north, and that both the quantity of the rain and the duration of the rainy season diminish on approaching the southern part of the State, or rather on receding from the mountainous section. The rain year of California does not conform to the calendar year, but extends from summer to summer, embracing the latter part of one year and the former part of the year ensuing. The natural division is in July or August—say the first of August. The calendar year fails to represent properly either a dry winter or a rainy one. Thus, the smallest quantity of rain in any one of the 17 calendar years was 10.50 inches, in 1865, while the climatic year 1850–'51 had but 7.12 inches, and 1863–'64, 8.49. On the other hand, the calendar year 1865 had but 10.50 inches, or half the average supply, from which it would be inferred that one, at least, of the two seasons in which it enters was dry: whereas, by reference to the table, it appears that both of these seasons had the full supply, being a fraction over 21 inches. It so transpired that the rain of one season was mainly in the latter part of 1864, and that of the latter season in the early part of 1866, leaving the intervening calendar year deficient.

In seasons of scanty rains the deficiency is not confined to certain districts, as in the Atlantic States, but it is general. The annual supply, however, varies greatly in different sections. Taking the gauge at San Francisco as a basis, very nearly the same quantity falls in the valleys surrounding the bay, and also in the Sacramento valley as far north as the capital. Speaking more precisely, the quantity in Sonoma and Napa counties is greater, and in Santa Clara, south of the bay, rather less, than at San Francisco. Proceeding southward, it diminishes rapidly, the rain-fall at Los Angeles and San Diego being only one-half that of the bay. In the north and northeast, among the Sierras, it is generally much greater, being three or four times as much in some localities.

In San Francisco [according to a table which we cannot conveniently reproduce] the rains of each month, during a period of 17 years, averaged as follows, in inches and fractions of inches: January, 4.51; February, 3.08; March, 2.76; April, 1.74; May, .82; June, .05; July, .02; August, .01; September, .09; October, .57; November, 2.74; December, 5.37.

The greatest quantity of rain for any one month, as the table shows, was 18.14 inches, in January, 1862—a winter memorable on account of destructive floods on the Pacific slope. The greatest quantity in any one month in eastern Pennsylvania, during a period of 30 years, was 13 inches; and this was in one of the summer months. So much as this never falls in a winter month in the Atlantic States. For one season of excessive drought there have been two of excessive rain. No two seasons in succession have given as much rain as 1866–'67 and 1867–'68.

The rains of each season are exhibited in the following table, in juxtaposition with the rains of each year:

Season.	*Rain.*	*Year.*	*Rain.*
1850–'51	11.12	1851	15.12
1851–'52	18.00	1852	25.60
1852–'53	33.46	1853	19.03
1853–'54	22.60	1854	22.12
1854–'55	24.10	1855	27.80
1855–'56	21.13	1856	22.01
1856–'57	19.90	1857	20.55
1857–'58	19.05	1858	19.65
1858–'59	19.76	1859	18.03
1859–'60	17.10	1860	15.15
1860–'61	14.54	1861	18.43
1861–'62	38.04	1862	31.05
1862–'63	15.19	1863	16.63
1863–'64	8.49	1864	13.05
1864–'65	21.30	1865	19.30
1865–'66	21.19	1866	32.98
1866–'67	32.22	1867	33.00
Mean	20.79	Mean	21.62

It appears that December is the month of greatest rain. The rainy tendency reaches its climax about Christmas, and then diminishes gradually until the termination of the season of rain, towards the latter end of May. June, July, August, and September are dry, with exceptions so light as scarcely to deserve notice, only 2.50 inches having fallen in these four months collectively in 17 years.

In almost every winter there are two rainy periods, with a drier period interposed, showing an analogy to the earlier and later rains of Palestine and other oriental countries. The month of February is the most frequent representative of the dry period; but the spring rains, which sometimes commence in this month, and other heavy rains which occasionally fall, swell the aggregate so as to prevent the exhibition of a deficiency in the table.

In speaking of the "rainy season," strangers will not infer that rain is perpetual, or nearly so, during that time. The term is employed only to contrast with the dry season, and it implies the possibility rather than the actual occurrence of rain. In more than half the winter there is not a drop beyond the necessities of agriculture, and even in the seasons of most rain much very pleasant weather is interspersed. If the winter be not extraordinary, it is generally regarded as the most pleasant season in the year. In the intervals of rain it is bright, sunny, and calm. It is spring rather than winter. The grass starts as soon as the soil is wet. At Christmas nature wears her green uniform almost throughout the entire State, and in February and March it is set with floral jewels. The blossoms increase in variety and profusion until April, when they are so abundant in many places as to show distinctly the yellow carpeting on hills five miles distant.

There is great irregularity in the time of the commencement of the rainy season. It never sets in before November, and sometimes not till the latter part of December. In the northern section the rains commence earlier than at San Francisco, and in the southern section later. The spring rains, which are of immense importance to agriculture, rarely fail. March is one of the surest months in this respect. April often gives a copious supply. There is a remarkable tendency to rain about the 20th of May, and a complete cessation soon afterwards. It is a striking feature of the climate, that when the weather puts on its rainy habit, the rain is apt to continue every day for one or two weeks, and then an interval may ensue without a drop for several weeks.

The rains of California are tropical in one respect, being showery, and not often regularly continuous for many hours. The monotony of an easterly storm, such as the Atlantic climate furnishes, is almost unknown here. The sun breaks forth frequently in the midst of a shower, and directly the sky is almost clear. Presently, when it is least expected, the rain is heard on the roof with the suddenness of a shower-bath.

The night is more favorable to rain than the day. No matter how dense the clouds, how fair the wind, how resolute the barometer in its promise of falling weather, the sun rarely fails to break up the arrangement before noon, and to tumble the clouds into confused masses or dissipate them altogether. But before night, or during the night, the clouds resume their function.

The prevailing direction of the cloud-current is from south to west, and the cloud supplying the rain is mostly of the cumulo-stratus or nimbus form, and quite low in the sky. What is singular, the rain begins most frequently to the northward, although the cloud comes from the south. The horizon in the south may be entirely clear under these circumstances, the cloud forming in view, and growing denser and denser in its northward travel, until it precipitates the rain.

The following table exhibits the mean quantity of rain falling at different stations, and the number of years on which the mean is computed. The stations are arranged in the order of their latitude, beginning with Fort Yuma and San Diego, which are about on the same parallel:

Localities.	*Term.*	*Mean.*
Fort Yuma	Four years.	3.24
San Diego	Three years.	10.43
Monterey	Four years.	12.20
Stockton	Four years.	15.10
San Francisco	Seventeen years.	20.79
Benicia	Eight years.	22.86
Sacramento	Twelve years.	18.23
Placerville	1861-'62.	86.00
Placerville	1862-'63.	26.00
South Yuba	1861-'62.	109.00
South Yuba	1866-'67.	81.56
Red Dog, Nevada county	Three years.	64.00
Fort Jones	Three years.	16.77
Hoopa valley, Klamath county	1861-'62.	129.15
Port Orford	Four years.	71.63
Astoria, Oregon	One and a half year.	86.35
Dalles, Cregon	Two years.	14.32
Fort Steilacoom, Washington Territory	Five years.	61.75

A comparison with the Atlantic slope presents a striking contrast. The smallest amount of rain that falls in one year, in any locality on the eastern side, say 20 inches, is at least equal to the average annual supply in the great grain-growing valleys of California; while, on the other hand, no locality on the eastern side, until you reach the tropical latitude of Florida, approaches the maximum of the Pacific slope. Thus California, with a range of 10 degrees of latitude, has a minimum of 3¼ inches at Fort Yuma, with a maximum exceeding 100 inches on the Sierras; while the Atlantic slope, with upwards of 20 degrees of latitude, and an expanse of territory vastly greater, with mountainous elevations of considerable height, presents a minimum of 20 inches with the same maximum as California.

To make the contrast more striking it may be added that the annual supply of rain has a greater range in California, in a distance of 50 miles from Sacramento City, than on the Atlantic slope, from Maine to Florida. Two or three times as much rain may fall in a single night in the mountains of California as in the entire year in the southeastern corner of the State.

The enormous quantity of 129 inches, at Hoopa valley, is stated on the authority of Dr. Kirkpatrick, of the United States army. In general, such extreme results are to be accepted with caution. The gauge may not have been fairly exposed, or it may have been wrongly graduated. But Dr. Kirkpatrick gives, in detail, the supply for each of three months, which seems to confirm his report: November, 44.10 inches; December, 23.79 inches; January, 30.95 inches. An observer on the South Yuba, Nevada county, reports 41.95 inches as falling there in the month of December, 1867. Instead of being surprised at the floods in the Sacramento valley, we may wonder what becomes of so much water.

It is worthy of note that Hoopa valley is but about 40 miles west of Fort Jones, where the annual supply is set down as 16.77 inches. Both places are on the northern border of the State, among the Coast mountains, and remote from the ocean.

In reference to the climate of California and its effect upon diseases of the lungs, Lorin Blodget says:

In California the proportion of cases of this class has been given imperfectly for two prints, on the authority of Dr. Hatch. Three years at Sacramento, which would represent the average of Upper California quite correctly, give 113 deaths in a total of 1,251, or 90.03 per 1,000, but of this he remarks: "Certain it is, however, that few of the cases of consumptive diseases hitherto met with in the valley have originated here. In most if not all the instances the disease has been implanted before reaching the country, and the most that can be said is, that it has not been benefited by the change. Of admissions to the city hospital, San Francisco, for nearly two years, August 7, 1851, to July 1, 1853, there were 84 in a total of 1,870 belonging to the respiratory class. Of these but 11 were of consumption—45 per 1,000 of all, and 5. 8 1,000 of consumption. It is believed that the cases of all diseases of this class originating in California will not reach four per cent. on the number of deaths, and will thus stand at less than one-third of the number of the eastern States. (Climatology of the United States, p. 475.)

PRINCIPAL ROUTES THROUGH CALIFORNIA.

Tables of distances, fares, and freights.[*]

STEAM NAVIGATION—INLAND SERVICE.

San Francisco to Sacramento, 125 *miles*.—Steamer Chrysopolis, 1,300 tons, and steamer Yosemite, 1,100 tons, daily, at 4 p. m.; returning, leave Sacramento at 2 p. m. Through fare, $4 and $5; to Benicia, $2; to Rio Vista, $3. Through freight, $3 per ton.

San Francisco to Stockton, 127 *miles*.—Steamer Julia, 600 tons, and steamer Cornelia, 600 tons, daily, at 4 p. m.; returning, leave Stockton at 4 p. m. Fare, $4 and $5. Freight, $2 50 and $3 per ton.

Sacramento to Marysville, 45 *miles*.—Steamers Flora and Governor Dana, daily, at 7 a. m.; returning, leave Marysville at 7 a. m. Fare, $4. Freight, $5 per ton.

Sacramento to Red Bluff, 105 *miles*.—Steamers Gem and Lark, every Saturday morning. Fare, $10. Freight, $17 per ton.

San Francisco to Napa, 47 *miles, via Vallejo and Mare Island*.—Steamer Amelia, summer, daily, at 9 a. m.; winter, Tuesday, Thursday, and Saturday, at 10 a. m. Fare to Napa, $3; to Vallejo and Mare Island, $2. Freight, $2 50 per ton; grain from Vallejo, $1 per ton.

San Francisco to Suisun, 40 *miles, via Benicia*.—Steamer Paul Pry, Tuesday, Thursday, and Saturday. Fare, $3; to Benicia, $2.

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[*] Compiled from Holdredge's "Guide-book of the Pacific," and other authorities.

Tables of distances, fares, and freights—Continued.

CENTRAL PACIFIC RAILROAD.

Stations.	Passenger tariff.	Freight t'ff, per ton.
Sacramento	......	......
Arcade	$0 70	$1 05
Antelope	1 50	2 25
Junction	1 80	2 70
Rocklin	2 20	3 30
Pino	2 50	3 75
Newcastle	3 10	4 65
Auburn	3 60	5 40
Clipper Gap	4 30	6 45
Colfax	5 50	8 25
Cisco	......	......

SAN FRANCISCO AND SAN JOSÉ RAILROAD.

Stations.	2d class to San F'cisco.	1st class to San F'cisco.
San Francisco	......	......
Mission	......	$0 20
Brannan's	......	25
Bernal	......	35
San Miguel	......	50
School House	......	60
12-Mile Farm	......	70
San Bruno	$0 40	75
17-Mile House	45	90
San Mateo	50	1 00
Belmont	65	1 25
Redwood City	75	1 50
Menlo Park	......	1 70
Mayfield	......	1 80
Mountain View	1 05	2 10
Lawrence's	1 15	2 25
Santa Clara	1 25	2 40
San José	1 25	2 50

SACRAMENTO TO STOCKTON.

Stations.	Distance.	Fare.	Freight.
Buckner's	14	$2 00	
Hicksville	22	3 00	
Liberty	29	3 50	
Woodbridge	35	4 00	
Stockton	50	5 00	

Steamers run at irregular intervals between Sacramento and Stockton, carrying freight only.

SACRAMENTO TO NAPA.

Stations.	Distance.	Fare.	Freight.
Solano House	17	....	Through freight, 5 cents per pound.
Silveyville	25	....	
Vacaville	35	$2 00	
Suisun	47	....	
Rockville	51	....	
Suscol	61	....	
Napa	65	4 00	

Connect at Suisun with stages for Benicia, and at Napa with Healdsburg with stages, and line for St. Helena and Calistoga.

Tables of distances, fares, and freights—Continued.

SACRAMENTO TO KNIGHT'S LANDING.

Stations.	Distance.	Fare.	Freight.
Woodland	20	$1 50	Through by team, 25 cents per cwt.
Cucheville	25	2 00	
Knight's Landing	35	3 00	

The Buckeye and Cache Creek mail branches off at Woodland.

STOCKTON TO CAMPO SECO.

Stations.	Distance.	Fare.	Freight.
Waterloo	8	$1 00	Through freight, 4 cents per pound.
Locust Shade	14	1 50	
Lockeford	18	2 00	
Poland's	20	2 00	
Camanche	28	3 00	
Poverty Bar	30	3 00	
Campo Seco	38	4 00	

Connect at Campo Seco with stages for Ione City, via Winter's Bar, Lancha Plana, and Buena Vista. Distance, fifteen miles; fare, $2.

STOCKTON TO COPPEROPOLIS.

Stations.	Distance.	Fare.	Freight.
Twelve-Mile House	12	$2 00	Stage, 4 cts. per pound; team, ½ cent to Telegraph City; stage, 4 cents per pound; team, ½ cent to Stockton.
Farmington	16	2 50	
Rock Creek	21	3 00	
Shafer's	28	4 00	
Telegraph City	29	4 00	
Copperopolis	36	5 00	

STOCKTON TO SAN ANDREAS.

Stations.	Distance.	Fare.	Freight.
Fifteen-Mile House	15	$2 00	Through by express, 10 cents per pound; team, 1 cent per pound.
Gorham	....	....	
Spring Valley	37	3 50	
San Andreas	45	5 00	

Connect with stage at Mokelumne Hill.

Tables of distances, fares, and freights—Continued.

MARYSVILLE TO LA PORTE.

Stations.	Distance.	Fare.	Freight.
Oroville, via Northern railroad	28	$2 00	
Forbestown	48	....	By team, $15 per ton.
Clipper Mills	56	....	
Strawberry Valley	60	....	
Eagleville	62	....	
La Porte	74	10 00	

Connect at La Porte with stages for Gibsonville.

Clipper Mills is situated near the eastern edge of Butte county, within one quarter of a mile of the Yuba county line, and in one of the best surgar-pine sections of the State, from which large quantities of clear lumber are made for the San Francisco market.

MARYSVILLE TO FORBESTOWN.

Stations.	Distance.	Fare.	Freight.
Sewalls	12	$1 50	
Bangor	20	2 50	
Miller's Ranch	24	3 00	
Brownsville	32	4 00	
Forbestown	37	5 00	

Connect at Forbestown with stages for La Porte.

MARYSVILLE TO DOWNIEVILLE.

Stations.	Distance.	Fare.	Freight.
Brown's Valley	12	$1 00	Express, 2 cents per pound.
Foster's Bar	36	....	
Camptonville	41	5 00	6 cents per pound.
Goodyear's Bar	57	9 00	9 cents per pound.
Downieville	62	10 00	10 cents per pound.

MARYSVILLE TO NORTH SAN JUAN.

Stations.	Distance.	Fare.	Freight.
Empire Ranch	16	$2 00	By express, in summer, ½ to ¾ cent per pound; in winter, 1 to 1½ cents per pound.
French Coral	30	3 00	
Birchville	32	3 50	
Sweetland	34	4 00	
North San Juan	37	5 00	

Freight from Lincoln, 35 miles distant, to North San Juan, in summer, ¾ to 1 cent per pound; in winter, 1½ to 2 cents per pound.

Connect at North San Juan with North Bloomfield, Forest City, and Nevada stages.

Tables of distances, fares, and freights—Continued.

OAKLAND TO SOMERVILLE.

Stations.	Distance.	Fare.	Freight.
Lafayette	12	$1 00	
*Walnut Creek	16	1 50	
†Pacheco	21	2 00	
Clayton	30	2 50	
Carbondale	33	2 75	
‡Somerville	35	3 00	

* Connect with Danville stages. † Connect with Martinez stages. ‡ Connect with Antioch stages.

WALNUT CREEK TO DANVILLE.

Stations.	Distance.	Fare.	Freight.
Alamo	3	$0 50	
Danville	7	75	

ANTIOCH TO SOMERSVILLE.

Stations.	Distance.	Fare.	Freight.
Somersville	6	$0 50	$4 per ton.

Connect at Antioch with Stockton boats.

OAKLAND TO SAN JOSÉ.

Stations.	Distance.	Fare.	Freight.
San Antonio	3	$0 50	1 cent per pound.
San Leandro	9	75	1 cent per pound.
San Lorenzo	12	1 00	1 cent per pound.
Alvarado	17	1 00	1 cent per pound.
Centreville	21	2 00	2 cents per pound.
Mission	26	2 00	2 cents per pound.
Warm Springs	30	2 00	2 cents per pound.
San José	42	2 50	2½ cents per pound.

SAN JOSÉ TO ALMADEN MINES.

Stations.	Distance.	Fare.	Freight.
Mines	12	$1 00	

Tables of distances, fares, and freights—Continued.

SAN JOSÉ TO LOS ANGELES.

Stations.	Distance.	Fare.	Freight.
Natividad	52	$4 50	4½ cents per pound.
Burns's	62	6 00	6 cents per pound.
Salinas	82	8 00	8 cents per pound.
Cock's	108	11 00	11 cents per pound.
Jolone	120	12 00	12 cents per pound.
Plieto	132	14 00	14 cents per pound.
Hot Springs	166	16 00	16 cents per pound.
San Luis Obispo	190	18 00	18 cents per pound.
Foxen's	240	19 00	19 cents per pound.
Santa Juez	265	20 00	20 cents per pound.
Santa Barbara	310	20 00	20 cents per pound.
San Buenaventura	342	23 00	23 cents per pound.
Las Posio	362	25 00	25 cents per pound.
Mountain Station	382	26 00	26 cents per pound.
Lone Station	402	27 00	27 cents per pound.
Los Angeles	418	28 00	28 cents per pound.

Connect with stages for San Pedro, San Diego, San Bernardino, and Clear Lake.

SAN JOSÉ TO SOUTH SAN JUAN.

Stations.	Distance.	Fare.	Freight.
Fifteen-Mile House	15	$1 00	1 cent per pound.
Twenty-one-Mile House	21	1 50	1½ cent per pound.
Burnett's	....	....	
Gilroy	30	2 00	2 cents per pound.
San Juan	42	3 00	3 cents per pound.

Connect at San Juan with stages for Watsonville, Salinas, and Monterey.

SAN JOSÉ TO VISALIA.

Stations.	Distance.	Fare.	Freight.
Hallenbeck's	50	$5 00	5 cents per pound.
San Luis	66	7 00	7 cents per pound.
Lone Willow	84	9 00	9 cents per pound.
Temple's	98	11 00	11 cents per pound.
Firebaum's	110	14 00	14 cents per pound.
Fresno City	128	17 00	17 cents per pound.
Elk Horn	150	20 00	20 cents per pound.
King's River	168	21 00	21 cents per pound.
Cross Creek	180	23 00	23 cents per pound.
Visalia	192	25 00	25 cents per pound.

Connect with 10.30 a. m. train from San Francisco. Semi-weekly in winter; through in three days.

Tables of distances, fares, and freights—Continued.

SAN JOSÉ TO LEXINGTON.

Station.	Distance.	Fare.	Freight.
Lexington	....	$1 00	50 cents per 100 pounds.

PETALUMA TO BODEGA.

Stations.	Distance.	Fare.	Freight.
Stony Point	8	$1 00	Express ½ cent per pound.
Sebastopol	16	2 00	Express 1 cent per pound.
Bodega	26	2 50	Express 1 cent per pound.

Connect at Petaluma with boats for San Francisco, and stages for Cloverdale and Mendocino.

PETALUMA TO CLOVERDALE.

Stations.	Distance.	Fare.	Freight.
Santa Rosa	16	$1 50	½ cent per pound.
Mark West	22	2 00	1 cent per pound.
Windsor	26	2 25	1¼ cent per pound.
Heardsburg	32	3 00	Team, 50 cents per 100 pounds.
Geyserville	39	3 50	1¾ cent per pound.
Cloverdale	49	4 50	2 cents per pound.

Connect at Heardsburg with stages for Skaggs's and the Geyser Springs.
Connect at Cloverdale with stages for Big River and Ukiah, and Long Valley.

PETALUMA TO DUNCAN'S MILL.

Stations.	Distance.	Fare.	Freight.
Two Rock Valley	8	$1 00	¼ cent per pound.
Bloomfield	14	1 50	½ cent per pound.
Valley Ford	18	2 00	¾ cent per pound.
Bodega Corners	22	2 50	1 cent per pound.
Bodega Bay	27	3 00	1 cent per pound.
Duncan's Point	31	3 50	1 cent per pound.
Duncan's Mill	36	4 00	1 cent per pound.

SUISUN TO KNOXVILLE.

Stations.	Distance.	Fare.	Freight.
Gordon Valley	....	....	
Big Cañon	25	$2 50	
Berreyesa Valley	30	3 00	
Sulphur Spring House	44	4 00	
Knoxville	50	5 00	1 cent per pound.

Tables of distances, fares, and freights—Continued.

NAPA TO UPPER LAKE.

Stations.	Distance.	Fare.	Freight.
Sebastopol	9	$0 50	
St. Helena	20	1 00	
Calistoga	27	2 00	
Lower Lake	62	7 00	
Kelsey Creek	72	7 50	
Lakeport	87	8 50	
Upper Lake	101	10 00	

Connect at Napa with Sacramento stages and boats for San Francisco.

LOS ANGELES TO SAN DIEGO.

Stations.	Distance.	Fare.	Freight.
Anaheim	30	$3 00	
San Juan Capistrano	60	6 00	
San Luis Rey	93	8 00	
San Diego	130	12 00	

LOS ANGELES TO SAN BERNARDINO.

Stations.	Distance.	Fare.	Freight.
El Monte	14	$1 00	
Mud Springs	30	2 50	
Sosamongo	45	4 00	
San Bernardino	65	5 00	2½ cents per pound.

Connect with Los Angeles and San José stages, and Los Angeles and Cleveland stages.

LOS ANGELES TO SAN PEDRO.

Stations.	Distance.	Fare.	Freight.
Sausee	7	$0 25	
Los Cuervos	11	0 25	
Wilmington	22	0 50	
San Pedro	26	0 50	

Table of distances from Honolulu, Hawaiian Islands, and from San Francisco, California, to various ports of the Pacific and the world; prepared by J. H. Riley, Bureau of Statistics, Treasury Department, and verified by J. E. Hilgard, esq., United States Coast Survey Office, to accompany statistical report on the Sandwich Islands.

From—	To—	Shortest distances.	Shortest sailing routes.
		Naut'l miles.	*Naut'l miles.*
Honolulu	New York, via Cape Horn		14,376
Do	New York, via Panama	4,320	6,587
Do	Panama, New Granada	4,560	4,560
Do	Callao, Peru	5,172	5,364
Do	Valparaiso, Chili	5,928	5,990
Do	Acapulco, Mexico	3,282	3,282
Do	Mazatlan, Mexico	2,856	2,856
Do	Guaymas, Mexico	2,580	3,012
Do	Cape San Lucas, Mexico	2,658	2,658
Do	San Diego, California	2,262	2,262
Do	San Francisco, California	2,080	2,080
Do	Portland, Oregon	2,256	2,330
Do	Victoria, Victoria Island	2,310	2,330
Do	New Westminster, British Columbia	2,358	2,410
Do	New Archangel, (Sitka Isl'd,) Alaska	2,370	2,370
Do	Yokohama, Japan	3,354	3,475
Do	Canton, China	4,848	5,017
Do	Sydney, New South Wales	4,405	4,820
Do	Melbourne, Victoria	4,810	5,280
San Francisco	Jeddo, via Honolulu	4,460	5,580
Do	Shanghai, via Honolulu	5,328	6,740
Do	Hong Kong, via Honolulu	6,012	7,000
Do	Sydney, via Honolulu	6,456	6,700
Do	Melbourne, via Honolulu	6,860	7,160
Do	Calcutta, via Honolulu	6,810	11,380
Do	New York, via Cape Horn		14,000
Do	New York, via Panama		5,287
Do	Panama	2,886	3,260
Do	Callao	3,912	4,010
Do	Valparaiso	5,124	5,300
Do	Acapulco, Mexico	1,740	1,850
Do	Manzanillo, Mexico	1,472	1,550
Do	Mazatlan, Mexico	1,200	1,390
Do	Guaymas, Mexico	864	1,530
Do	Cape San Lucas, Mexico	1,104	1,145
Do	San Diego, California	400	450
Do	Portland, Oregon	462	570
Do	Victoria, Vancouver's Island	654	746
Do	New Westminster, British Columbia	690	815
Do	New Archangel, (Sitka Island)	1,284	1,290
Do	Kanagawa, Japan		4,900
Aspinwall	Milford Haven, England	4,390	4,500
Panama	Tahiti, Society Islands	4,430	4,540
Do	Sydney, New South Wales	7,638	7,690
Do	Canton, China	8,760	9,577

SECTION XXII.

GENERAL SUMMARY.

AREA OF CALIFORNIA, ARABLE LANDS, POPULATION, PRODUCT OF PRECIOUS METALS, SHIPMENTS OF TREASURE, COINAGE, &C.

The Commissioner of the General Land Office, in his Report for 1867, says:

California extends along the Pacific coast 750 miles, with an average breadth of 230. Its area is 188,981 square miles, or 120,947,840 acres, of which not less than 89,000,000, including swamp and tule lands capable of reclamation, are suited to some kinds of profitable husbandry. Of these over 40,000,000 are fit for the plough, and the remainder present excellent facilities for stock-raising, fruit-growing, and all the other branches of agriculture. This agricultural area exceeds that of Great Britain and Ireland, or the entire peninsula of Italy. The State also contains about 40,000,000 of acres of mineral land, unsurpassed for productiveness.

About 30,000,000 of acres have been surveyed, leaving a residue unsurveyed of 90,000,000. Nearly 9,000,000 have been granted to the State by the general government, under various acts of Congress, for common schools, agricultural colleges, public buildings, and internal improvements.

Of the 40,000,000 acres of arable land, 14,000,000 are found in the basin of the Sacramento and San Joaquin rivers, 16,000,000 in the coast valleys, and the residue in the region called the "Colorado desert," in Owen's river valley and the Klamath basin. When irrigation is practiced on an extensive scale, as it must be within a few years, and the valley of the Colorado is brought under its influence, much of what is now characterized as "desert" will become productive and valuable. The land not fit for the plough, but valuable for grazing and in a measure for horticultural purposes, especially the grape culture, is to be found on the foot-hills and slopes of the Sierra Nevada and Coast Range mountains.

Langley, in his Pacific Coast Directory, estimates that 65,000,000 acres are adapted to agriculture, 15,000,000 to grazing purposes, that 4,000,000 are swamp and overflowed lands; also, that the greater portion of the latter is capable of reclamation, and is to a great extent each year being added to the cultivated lands of the State. The area of lakes, bays and mountains he estimates at 14,000,000.

Of the 65,000,000 acres of agricultural land, [says the same authority,] there were returned by the county assessors, for the year 1865, as under fence, 4,055,690 acres, and under cultivation 1,504,680 acres. It will thus be seen that there is but six per cent. of the agricultural land of the State under fence, and little over two and one-half per cent. under cultivation. The returns for 1866 will increase these estimates about 15 per cent.

[From Langley's Pacific Coast Directory.]

Table exhibiting the county seats of the different counties, legal distances, population of 1860 and 1866, &c.

Counties.	County seat.	Legal distance from State capital.	Date of organization.	Population in 1860.	Vote, 1864.	Children under 15 years of age, 1866.*	Estim't'd population, 1866.*	Am't of real and personal property in 1866.
		Miles.						
Alameda	San Leandro	135	1853	8,926	2,278	4,631	15,430	$4,533,560
Alpine	Silver Mountain	140	1864	....	612	231	....	450,000
Amador	Jackson	55	1854	10,933	2,591	2,816	9,380	1,907,252
Butte	Oroville	75	1850	12,107	2,856	2,806	9,350	5,128,358
Calaveras	San Andreas	60	1850	16,302	3,635	3,600	12,000	1,890,657
Colusa	Colusa	75	1850	2,274	699	956	3,180	1,689,155
Contra Costa	Martinez	90	1850	5,328	1,480	2,682	8,960	2,544,282
Del Norte	Crescent City	465	1857	1,992	306	299	....	379,085
El Dorado	Placerville	50	1850	20,562	5,071	3,892	12,970	3,476,536
Fresno	Millerton	190	1856	4,605	451	486	1,680	826,000
Humboldt	Eureka	390	1853	2,694	685	1,601	5,330	2,200,000
Inyo	Independence	†	1866	....	....	28	....	‡500,000
Kern	Havilah	†	1866	....	....	....	....	819,825
Klamath	Orleans Bar	450	1851	1,803	261	197	....	288,089
Lake	Lakeport	120	1861	....	618	895	3,350	395,708
Lassen	Susanville	200	1864	....	554	426	1,420	‡750,000
Los Angeles	Los Angeles	550	1850	11,336	1,299	3,882	12,940	2,353,382
Marin	San Rafael	135	1850	3,334	1,095	1,347	4,490	2,247,571
Mariposa	Mariposa	145	1850	6,243	1,609	1,253	4,170	1,237,470
Mendocino	Ukiah	†	1850	3,967	1,354	2,301	7,670	1,900,000
Merced	Snelling	115	1855	1,141	291	596	1,980	842,847
Mono	Bridgeport	260	1861	....	305	....	....	357,961
Monterey	Monterey	245	1850	4,739	779	2,123	7,000	1,265,450
Napa	Napa City	60	1850	5,515	1,328	2,175	7,250	2,797,688
Nevada	Nevada City	65	1851	16,447	4,577	4,970	16,560	5,173,837
Placer	Auburn	35	1851	13,270	3,792	3,123	10,410	2,826,243
Plumas	Quincy	145	1854	4,363	1,497	982	3,670	1,192,521
Sacramento	Sacramento	Capital.	1850	24,145	5,956	6,914	23,000	10,316,976
San Bernardino	San Bernardino	600	1854	5,554	736	1,679	5,260	695,201
San Diego	San Diego	750	1850	4,326	294	454	1,500	448,706
San Francisco	San Francisco	117	1856	56,805	21,019	30,694	102,313	88,402,274
San Joaquin	Stockton	51	1850	9,434	3,276	5,143	17,140	5,275,016
San Luis Obispo	San Luis Obispo	335	1850	1,782	408	856	2,850	758,330
San Mateo	Redwood City	140	1856	3,214	977	1,544	5,148	2,700,000
Santa Barbara	Santa Barbara	435	1850	3,545	423	1,641	5,470	771,861
Santa Clara	San José	150	1850	11,912	3,432	6,509	21,696	7,972,899
Santa Cruz	Santa Cruz	245	1850	4,945	1,426	2,780	9,260	1,441,739
Shasta	Shasta	185	1850	4,360	1,471	1,276	4,250	1,091,723
Sierra	Downieville	110	1852	11,389	3,088	1,555	5,180	2,314,096
Siskiyou	Yreka	350	1852	7,629	1,882	1,727	5,756	1,617,822
Solano	Fairfield	90	1850	7,170	2,163	4,755	15,850	3,044,120
Sonoma	Santa Rosa	130	1850	11,867	4,362	7,585	25,280	5,346,686
Stanislaus	Knight's Ferry	85	1854	2,245	623	940	3,460	1,026,216
Sutter	Yuba City	50	1850	3,390	1,263	1,739	5,796	1,778,268
Tehama	Red Bluff	145	1856	4,044	846	1,016	3,386	1,598,500
Trinity	Weaverville	255	1851	5,125	1,114	728	2,426	653,189
Tulare	Visalia	250	1852	4,638	1,167	1,363	4,890	1,299,379
Tuolumne	Sonora	115	1850	16,229	3,155	2,951	9,836	‡2,300,000
Yolo	Woodland	16	1850	4,716	1,128	2,125	7,080	2,156,427
Yuba	Marysville	50	1850	13,671	3,203	3,126	10,420	4,150,500
Total	....	....	....	380,016	103,135	137,498	456,437	197,133,345

NOTE.—Total estimated population in 1867, 480,000.

* The figures in the above table referring to the population of this State for 1866 are taken from the report of the State superintendent of public schools, Mr. John Swett, and are estimated upon the basis that the school children under fifteen years of age constitute thirty per cent. of the population. In the absence of official data, this is probably as fair a mode as can be adopted to arrive at an approximation of the population of our State. We think, however, that the estimate for San Francisco is at least 18,000 too low.—*Compiler.*

† Not yet defined by law.

‡ Estimated.

Statement of the number of passengers by sea arriving at and departing from the port of San Francisco during the first, second, third, and fourth quarters of 1867, *as declared at the custom-house.*

	Arrivals.					Departures.				
	1st quarter.	2d quarter.	3d quarter.	4th quarter.	Total.	1st quarter.	2d quarter.	3d quarter.	4th quarter.	Total.
Panama, New Granada	3,089	6,409	5,654	5,630	20,782	2,227	3,168	2,194	2,434	10,074
San Juan del Sur	1,766	1,519	1,674	1,835	6,791	867	1,413	1,005	1,055	4,340
Victoria, British Columbia	242	236	341	405	1,224	77	134	120	71	402
China and Japan	463	2,129	1,429	273	4,294	424	410	1,232	2,433	4,499
Europe, direct	12	......	6	13	31	1	......	2	1	4
Eastern ports, direct	4	......	......	......	4	......	......	......	......	......
Australia	152	315	702	98	1,267	......	......	......	67	67
Mexico	193	73	230	97	593	156	111	67	107	441
Hawaiian islands	145	227	67	105	544	63	51	47	99	260
Other countries	20	18	47	54	139	15	9	344	14	382
Total	6,086	10,926	10,150	8,510	35,672	3,881	5,296	5,011	6,281	20,469

RECAPITULATION.

	1st quarter.	2d quarter.	3d quarter.	4th quarter.	Total.
Arrivals	6,086	10,926	10,150	8,510	35,672
Departures	3,881	5,296	5,011	6,281	20,469
Gain	2,205	5,630	5,139	2,229	15,203

One of the most agreeable features of the past year is the increase in population which reached our shores during its passage. The arrivals during the second and third quarters were more numerous than in the first and fourth quarters, while the departures for the fourth quarter exceed those of any other. This we believe to be contrary to the general rule. Heretofore the greatest number of arrivals by sea have been during the last quarter, and the departures fewer. People at the east are generally more anxious to leave when the rigors of their severe winters commence, while those who have been residents of the Pacific coast usually evince more desire to go eastward when the spring has fairly opened and our winds commence. During the year 1867 the arrivals by sea exceeded the departures by 15,203. But we have also received large additions overland. Our probable increase from abroad will reach 27,000 souls. Large numbers are known to be on their way from Sweden, Germany, and Norway, and considerable tracts of fine farming land have already been purchased and made ready for their reception.—[Commercial Herald and Market Review.

PRODUCT OF PRECIOUS METALS, ETC.

RECEIPTS AND EXPORTS OF TREASURE.—The following tables derived from official sources are copied from the Commercial Herald and Market Review:

TREASURE PRODUCT, IMPORTS, ETC.

The receipts of treasure from all sources through regular public channels during the past twelve months, as compared with 1866, have been as follows:

	1866.	1867.
From California northern mines	$38,715,340	$40,927,309
From California southern mines	5,149,749	4,477,461
From Coastwise ports, Oregon, &c	5,940,536	6,192,734
Imports, foreign, British Columbia, &c	2,887,028	3,960,322
Total	52,692,653	55,566,826

From an examination of the statements of treasure received in this city, it will be seen that there has been an increase of more than $2,000,000 in the amount received from the northern mines the past over the preceding year; the greater portion of this increment being due to the State of Nevada. The receipts from the southern mines have meantime fallen off materially, while those from coastwise ports, Oregon, &c., have increased slightly, and those from British Columbia and other foreign ports very considerably. The bullion transmitted the past year to this city, through Wells, Fargo & Co's. express, as being the product of the State of Nevada, amounted to $18,000,000. To this sum may be added, perhaps, $500,000 to represent the amount of bullion arriving during the year in private hands, making a total product for that State for 1867 of $18,500,000. Of this sum about $2,000,000 may be set down as the product of Reese river and other outside localities, leaving the balance $16,000,000 to be credited to the Comstock lode. In apportioning the product of these several outside localities, about $1,500,000 should be set down to account of what is usually termed the Reese river country, which, for the end in view, should be made to embrace all the outlying districts about Austin; in fact, the whole of Lander, Nye, and Lincoln counties, excepting, perhaps, the Silver Peak district, which lies in Esmeralda county, and which has turned out but little bullion the past year. The remaining half million may be divided between Humboldt and Esmeralda counties in the following proportions: $300,000 for the former, and $200,000 for the latter, none of the other counties in the State, except Storey, containing the Comstock lode, producing any bullion worth naming. These figures, as will be seen, denote for the year in question a very marked increase in the State at large over the yield of any former year; this rate of increase being in about the same ratio for the Comstock lode and the outside precincts. The product of the former for 1866 was estimated at $16,250,000, and of the other localities named, $1,250,000, of which $1,000,000 was assigned to Reese river, and $250,000 to Humboldt and Esmeralda. While, however, such gratifying gains have, during this period, signalized the progress of Nevada, the year has rather been one of preliminary preparation than of progress and fruition; the most of the companies owning what may be considered the more promising of the outside mines, having been engaged at heavy expense in developing their claims, and erecting mills—very few of them in active productive operation. These mills will soon be completed, and the mines be thoroughly explored, and placed in condition to yield ores largely, rendering it probable that still more marked additions will be made to the bullion returns of the State the present than was done the past year, and almost insuring for that State a total product for 1868 of $20,000,000. Even if the Comstock mines should not advance their yield, or should suffer some small abatement, this result will probably be attained, as there is an almost certainty of the mines at Silver Peak and those about Belmont turning out a large amount of bullion the current year, to say nothing of the promised gains for Humboldt and Esmeralda.

The following table shows the value and destination of treasure shipments from this port during the past 14 years—from 1854 to 1867, inclusive:

Years.	East'n ports.	England.	China.	Panama.	Other ports.	Totals.
1854....	$46,533,166	$3,781,080	$965,887	$204,592	$560,908	$52,045,633
1855....	38,730,564	5,182,156	889,675	231,207	128,129	45,161,731
1856....	39,895,294	8,666,289	1,308,852	253,268	573,732	50,697,434
1857....	35,531,778	9,347,743	2,993,264	410,929	692,978	48,976,692
1858....	35,891,236	9,265,739	1,916,007	299,265	175,779	47,548,026
1859....	40,146,437	3,910,930	3,100,756	279,949	202,390	47,640,462
1860....	35,719,296	2,672,936	3,374,680	300,819	258,185	42,325,916
1861....	32,628,011	4,061,779	3,541,279	349,769	95,920	40,676,758
1862....	26,194,035	12,950,140	2,660,754	434,508	322,324	42,561,761
1863....	10,388,330	28,467,256	4,206,370	2,503,296	505,667	46,071,920
1864....	13,316,122	34,436,423	7,888,973	378,795	686,888	56,707,201
1865....	20,583,390	15,432,639	6,963,522	1,224,845	1,103,832	45,308,227
1866....	29,244,891	6,532,208	6,527,287	511,550	1,548,457	44,364,393
1867....	23,355,903	5,841,184	9,031,504	372,552	3,075,149	41,676,292
Totals.	428,159,453	150,548,502	55,368,810	7,755,344	9,930,338	651,762,446

RECEIPTS OF TREASURE.

The following tables comprise the receipts of coined and uncoined treasure from the interior and coastwise during the years 1865, 1866, and 1867:

FROM THE NORTHERN MINES.

	1865.			1866.			1867.		
	Uncoined.	Coined.	Total.	Uncoined.	Coined.	Total.	Uncoined.	Coined.	Total.
Jan........	$3,236,768	$440,637	$3,677,405	$2,347,832	$452,288	$2,800,120	$3,077,269	$439,264	$3,516,533
Feb........	2,995,163	245,174	3,240,337	2,846,130	173,030	3,019,160	2,262,155	265,857	2,528,012
March.....	3,875,331	216,853	4,092,184	2,567,000	182,000	2,749,000	2,719,436	281,876	3,001,312
April......	3,258,420	279,504	3,537,924	2,951.030	599,415	3,550,445	3,943,605	246,910	4,190,515
May.......	3,851,533	211,808	4,063,341	3,523,482	360,670	3,884,152	3,521,435	250,354	3,771,789
June......	3,416,304	271,438	3,687,742	3,357,702	230,373	3,588,075	3,465,576	273,403	3,738,979
July.......	2,860,830	274,776	3,135,606	3,158,584	445,000	3,603,584	3,701,611	291,524	3,993,135
Aug........	3,058,004	209,118	3,267,122	3,293,276	243,097	3,536,373	3,736,035	209,890	3,945,925
Sept.......	2,613,623	185,342	2,798,965	2,802,649	241,443	3,044,092	3,101,754	185,920	3,287,674
Oct........	2,688,079	225,977	2,914,056	3,128,320	198,420	3,326,740	3,082,637	307,219	3,389,856
Nov.......	2,614,218	250,853	2,865,071	2,621,219	196,337	2,817,556	2,968,419	253,263	3,221,682
Dec.......	2,181,064	281,630	2,462,694	2,595,531	200,512	2,796,043	1,998,695	343,202	2,341,897
Total...	36,649,337	3,093,110	39,742,447	35,192,755	3,522,585	38,715,340	37,578,627	3,348,682	40,927,309

FROM THE SOUTHERN MINES.

Jan........	$425,711	$123,374	$549,085	$289,984	$138,836	$428,820	$220,367	$166,707	$387,074
Feb........	386,287	72,283	458,570	308,716	65,431	374,147	203,918	57,452	261,370
March.....	530,210	129,073	659,283	250,000	57,000	307,000	203,250	98,674	301,924
April......	471,963	79,600	551,563	355,295	64,479	419,774	287,478	123,275	410,753
May.......	501,267	135,444	636,711	269,045	84,080	353,125	290,543	130,600	421,143
June......	433,818	86,534	520,352	296,168	119,350	415.518	314,402	114,107	428,509
July.......	408,903	136,363	545,266	306,373	70,432	376,805	309,661	87,910	397,571
Aug........	407,355	100,404	507,759	309,361	79,595	388,956	262,188	75,825	338,013
Sept.......	421,033	82,261	503,294	256,683	97,608	354,291	237,027	104,969	341,996
Oct........	437,274	156,642	593,916	488,450	87,614	576,064	263,729	132,028	395,757
Nov.......	373,433	122,935	496,368	490,300	92,330	582,630	254,921	184,837	439,758
Dec.......	311,159	95,634	406,793	486,600	86,019	572,619	165,873	187,721	353,594
Total...	5,108,413	1,320,547	6,428,960	4,106,975	1,042,774	5,149,749	3,013,356	1,464,105	4,477,461

COASTWISE.

Jan........	$333,123	$128,611	$461,734	$257,930	$30,853	$288,783	$344,440	$15,381	$359,821
Feb........	219,926	59,978	279,904	174,219	80,972	255,191	128,799	10,884	139,683
March....	167,411	40,911	208,322	197,023	20,577	217,600	119,398	23,284	142,682
April......	291,949	60,873	352,822	274,620	29,974	304,594	344,075	7,450	351,525
May.......	362,159	47,975	410,134	411,427	90,956	502,383	380,780	11,636	392,416
June......	791,928	52,669	844,597	460,132	42,388	502,520	366,265	8,976	375,241
July.......	823,641	31,269	854,910	680,953	37,591	718,544	760,693	214,744	975,437
Aug........	786,558	32,241	818,799	932,392	56,959	989,351	1,006,186	2,536	1,008,722
Sept.......	954,813	28,876	983,689	621,426	7,618	629,044	490,853	5,556	496,409
Oct........	634,116	23,864	657,980	559,212	54,055	613,267	744,349	80,980	825,329
Nov.......	794,085	16,818	810,903	412,183	45,300	457,483	536,548	100,520	637,068
Dec.......	788,802	24,180	812,982	415,583	32,193	447,776	442,951	45,450	488,401
Total...	6,948,511	548,265	7,496,776	5,397,100	529,436	5,926,536	5,665,337	527,397	6,192,734

RECAPITULATION.

	1865.	1866.	1867.
Uncoined..	$48,706,261	$44,696,830	$46,257,320
Coined..	4,961,922	5,094,895	5,340,184
Total...	53,668,183	49,791,725	51,597,504

Statement of the amount and destination of treasure exported from San Francisco during the year ending December 31, 1867, as declared at the custom-house.

TO NEW YORK.

In January	$2,809,235 55	
In February	1,396,207 24	
In March	1,646,058 86	
In April	1,186,780 34	
In May	2,535,232 56	
In June	2,661,643 57	
In July	2,389,688 29	
In August	1,610,041 45	
In September	1,337,755 30	
In October	1,024,552 18	
In November	1,957,828 43	
In December	2,800,881 68	
		$23,355,903 45

TO ENGLAND.

In January	703,070 85	
In February	384,098 00	
In March	357,661 60	
In April	297,174 02	
In May	788,772 13	
In June	502,834 36	
In July	616,302 22	
In August	515,691 91	
In September	493,065 34	
In October	704,600 43	
In November	321,514 42	
In December	156,408 71	
		5,841,183 99

TO FRANCE.

In January	122,331 56	
In February	105,079 91	
In March	67,000 00	
In April	69,537 25	
In May	101,509 48	
In June	117,400 57	
In July	183,751 64	
In August	234,905 70	
In September	106,600 42	
In October	34,772 40	
In November	65,555 27	
In December	74,791 53	
		1,283,235 73

TO CHINA.

In January	806,076 27	
In February	376,206 32	
In March	110,642 72	
In April	1,081,513 57	
In May	760,027 73	
In June	698,933 73	
In July	1,746,078 69	
In August	385,540 53	
In September	1,180,308 18	
In October	1,119,629 84	
In December	766,546 77	
		9,031,504 35

TO JAPAN.

In January	21,685 46	
In March	10,000 00	
In April	2,238 72	
In May	2,845 00	
In July	1,100 00	
In September	10,000 00	
In October	650 00	
In December	593,430 34	
		641,949 52

TO PANAMA.

In January	$30,000 00	
In February	30,000 00	
In March	30,000 00	
In April	29,000 00	
In May	30.000 00	
In June	30,000 00	
In July	30,000 00	
In August	32,127 40	
In September	40,000 00	
In October	30,000 00	
In November	31,424 30	
In December	30,000 00	
		$372,551 70

TO CENTRAL AMERICA.

In February	20,000 00	
In April	45,550 00	
In May	28,400 00	
In June	8,000 00	
In July	3,000 00	
In October	8,660 00	
In December	58,370 00	
		171,980 00

TO HAWAIIAN ISLANDS.

In April	1,300 00	
In June	1,000 00	
In July	1,000 00	
In August	5,000 00	
In October	18,906 00	
In November	29,826 42	
		57,032 45

TO MEXICO.

In January	10,000 00	
In February	3,000 00	
In March	13,000 00	
In October	5,000 00	
In December	11,000 00	
		42,000 00

TO VALPARAISO.

In February	399,849 08	
In March	323,601 89	
		723,450 97

TO TAHITI.

In February		500 00

TO VICTORIA.

In February	50,000 00	
In October	80,000 00	
In December	25,000 00	
		155,000 00

Total, 1867	*41,676,722 16
Total, 1866	44,364,393 05
Decrease this year	2,688,100 89

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* To the figures representing the amount of treasure shipped hence in 1867 would justly be added about $6,000,000 sent east by the United States sub-treasurer in this city, whereby the total sum sent out of the country reached $48,000,000 for the last year. This officer shipped on government account $11,500,000 in 1866, though, so near as we can learn, not over $6,000,000 were shipped by him last year.

AMOUNT OF BULLION ASSAYED AND TAXED.—The following table, prepared at the office of the Commissioner of Internal Revenue, shows the total amount of bullion produced in the United States, upon which the revenue tax of one-half of one per cent. has been collected during the calendar year 1867.* It should be observed that the bullion is not always assayed and assessed in the State or Territory in which it is produced. California, for example, shows a total estimated value of gold and silver bullion in coin of $28,840,139; this includes a considerable portion of the product of Idaho, Washington Territory, and Oregon. Nearly all the bullion produced in Nevada is assessed in that State; whilst in New York and Pennsylvania the assessments are upon bullion deposited there from other sources. The table, therefore, is chiefly valuable as showing the aggregate product upon which taxes have been collected. The total value assessed, viz: $58,175,047, and the actual product for 1867, as estimated in letter to the Secretary of the Treasury, (page 3,) viz: $75,000,000, show a difference of $16,824,953. Of this amount a portion may be accounted for as remaining unassayed, and some may have escaped taxation.

Statement showing the tax returned on bullion as assayed from each State and Territory of the United States for the calendar year 1867; also, the value of the bullion in currency and its estimated value in coin, assuming that the average premium on gold for the year was 38⅝ per cent., or that one dollar in currency was worth seventy-two cents in coin.

States and Territories.	Tax in currency on gold bullion.	Tax in currency on silver bullion.	Value of the gold bullion, in currency.	Value of the silver bullion, in currency.
California	$193,366 74	$6,912 00	$38,673,348	$1,382,400
Colorado	1,447 45	....	289,490	....
Idaho	5,680 12	1,682 02	1,136,024	336,404
Montana	11,413 70	44	2,282,740	88
Nevada	43,865 20	77,021 21	8,773,040	15,404,242
New York	28,140 27	3,007 70	5,638,054	601,540
Oregon	10,024 60	4 61	2,004,920	922
Pennsylvania	14,030 14	1,747 00	2,806,028	349,400
Utah	4,087 16	....	817,432	....
Washington	1,563 02	....	312,604	....
Total	313,618 40	90,374 98	62,723,680	18,074,996

States and Territories.	Total value of gold and silver bullion, in currency.	Estimated value of gold bullion, in coin.	Estimated value of silver bullion, in coin.	Total estimated value of gold and silver bullion, in coin.
California	$40,055,748	$27,844,811	$995,328	$28,840,139
Colorado	289,490	208,433	....	208,433
Idaho	1,472,428	817,937	242,211	1,060,148
Montana	2,282,828	1,643,573	63	1,643,636
Nevada	24,177,282	6,316,589	11,091,054	17,407,643
New York	6,239,594	4,052,199	433,109	4,485,308
Oregon	2,005,842	1,443,542	664	1,444,206
Pennsylvania	3,155,428	2,020,340	251,568	2,271,908
Utah	817,432	588,551	....	588,551
Washington	312,604	225,075	....	225,075
Total	80,798,676	45,161,050	13,013,997	58,175,047

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* This tax is abolished under the new internal revenue act.

Deposits and Coinage.—The following is a statement of the deposits and coinage at the branch mint of the United States, in San Francisco, during the year ending December 31, 1867:

	Value.
Gold deposits	$18,923,152 17
Silver deposits and purchases	613,117 94
Total deposits	19,536,270 11

Statement of coinage executed.

Denominations.	No. of pieces.	Value.
GOLD.		
Double eagles	920,750	$18,415,000 00
Eagles	9,000	90,000 00
Half eagles	29,000	145,000 00
Quarter eagles	28,000	70,000 00
Total	986,750	18,720,000 00
SILVER.		
Half dollars	1,196,000	598,000 00
Quarter dollars	48,000	12,000 00
Dimes	140,000	14,000 00
Half dimes	120,000	6,000 00
Fine bars	20	20,534 92
Total	1,504,020	650,534 92
RECAPITULATION.		
Gold coinage	986,750	18,720,000 00
Silver	1,504,020	650,534 92
Total	2,490,770	19,370,534 92

The deposits for the year ending December 31, 1867, were of the following character:

GOLD DEPOSITS.

California, bullion	$5,700,871 12	
Idaho, "	1,144,483 04	
Oregon, "	319,620 90	
Montana, "	309,843 32	
Nevada, "	49,030 47	
Arizona, "	48,797 73	
Parted from silver bullion	168,901 92	
		$7,741,548 50
Fine bars	10,980,791 94	
Foreign coin	153,453 31	
Foreign bullion	47,358 42	
		11,181,603 67
Total gold		18,923,152 17

SILVER.

Nevada, bullion	$205,618 87	
Arizona, "	8,425 74	
Idaho, "	39,727 45	
Parted from gold bullion	69,999 56	
		$323,771 62
Bars	239,799 25	
Foreign coin	27,595 31	
Foreign bullion	21,951 76	
		289,346 32
Total silver		613,117 94
Silver bars stamped		$20,534 92
Total gold and silver		19,536,270 11
Fine bars, total		20,534 92

TOTAL DEPOSITS AND COINAGE.—The Secretary of the Treasury in his annual report for the year 1867 states that the total value of the bullion deposited at the mint and branches during the fiscal year was $41,893,100 76, of which $40,069,200 06 was in gold and $1,823,900 70 in silver. Deducting the redeposit, the amount of actual deposit was $34,537,048 39.

The coinage for the year was, in gold coin, $28,217,187 50; gold bars, $11,621,691 32; silver coin, $986,871; silver bars, $575,823 18; nickel, copper, and bronze coinage, (one, two, three, and five-cent pieces,) $1,879,540. Total coinage, $31,083,598 50. Total bars stamped, $12,197,514 50.

The gold deposits of domestic production were, at Philadelphia, $2,418,157 89; at San Francisco, $17,936,169 40; at New York, $10,320,821 55; at Denver, $130,559 70. The silver deposits were, at Philadelphia, $37,399 72; San Francisco, $744,387 48; New York, $274,893 19.

The gold and silver deposits of foreign production were $2,674,619 46.

The amount of gold coined at Philadelphia was $10,072,060 86; at San Francisco, $18,225,000; of silver, at Philadelphia, $357,490 38; at San Francisco, $780,048 54; of bronze, nickel, and copper, at Philadelphia, $1,879,540. Total number of pieces struck, 54,110,384.

NEVADA.

SECTION I.

TOPOGRAPHY, PHYSICAL FEATURES, AND NATURAL PRODUCTIONS.

System of Mountains, Plains, and Valleys.—This State, in common with the entire region lying between the Sierra Nevada and the Rocky mountains, is an elevated plain, having a general altitude of about 4,000 feet above the level of the sea. Crossing this plateau are many mountain ranges, the most of which have a northerly and southerly course, being separated from each other by valleys from 5 to 20 miles wide, which is also about the width of the adjacent mountains, measured on a straight line from base to base. These mountains have an absolute height varying from 5,000 to 12,000 feet, being from 1,000 to 8,000 feet above the common level of the country. The Sierra Nevada, forming for some distance a natural barrier along the western and southwestern parts of the State, varies in height from 7,000 to 13,000 feet. This range is covered with heavy forests to its very base, while all the others in the interior of the State are barren of wood, or but sparsely timbered. This alternation of mountains and valleys is preserved with great uniformity throughout all parts of the State, more especially in the central and eastern portions. In places these mountains disappear, or so contract as to transform the valleys into broad plains or basins, some of which are open and unobstructed, while others are dotted with buttes, or covered with groups of rugged hills. At points along their course these ranges are much depressed, or cut by ravines striking across their summits, forming passes so low, and with such gradual slopes on either side, as to greatly facilitate the construction of wagon roads, and even railways, across them. In some parts of the country the mountains, instead of running in parallel chains, are broken into confused and detached masses, their longitudinal axis conforming towards no common direction. The sides of these mountains are everywhere cut by deep ravines or cañons, the most of them running from crest to base, and usually at nearly right angles with their general course. In some places these ravines are but one or two, while in others they are five or six miles apart, dividing the mountain slopes into enormous ridges, some of them 2,000 or 3,000 feet above the separating cañons. The latter are in some cases well watered, perennial streams flowing through them, rendering irrigation of their banks always feasible, while in others there are neither springs nor running streams, whole mountain ranges being, like the adjacent plains, nearly or quite destitute of water. As in the Sierra Nevada, these interior ranges contain a few high ridges and peaks, upon which in places sheltered from the sun, or where deep drifts have been formed, the snow lies throughout the year. Granite, sienite, slate, limestone, and porphyry, are the prevailing rocks in the composition of the Nevada mountains, which have generally a rounded and dome-like contour, though occasionally shooting up into pyramidal peaks and spire-shaped summits. The tops of the divides between the lateral cañons are especially apt to be sharp and rugged, the bare and splintered rocks occasionally standing far above the crest of the ridge, and sometimes strongly inclined towards the comb of the principal mountain. While the most of these ranges are covered with a scanty growth of bunch grass, and with patches of piñon, juniper, and other scrubby trees, much of their surface is destitute of both grass and every other species of useful vegetation, fully three-fourths being without any kind of timber. Along some of the streams flowing through the cañons are narrow strips of arable land which frequently, at the point where the former opens into the valleys, spread out into tracts of several acres, affording a sufficiency of tillable land for gardens and small farms. Some of these streams are fringed with cottonwood, birch, willow, wild cherry, and similar trees, the most of them small, and of but little value, mixed with which are often varieties of wild vines, rose, currant or gooseberry bushes, and other shrubbery. Up the most of these cañons it is no difficult matter to construct wagon roads leading quite to the summits of the mountains, a consideration of moment, as the latter, the principal repositories of the precious metals, are thus rendered easily accessible to loaded teams; and these mountain ridges sometimes run for 100 miles or more without any material deviation from their general course. So also do the adjacent valleys extend for a like distance without other obstruction than perhaps an occasional butte, or outstanding spur, and with no perceptible variation of level. Sometimes these valleys, owing to a subsidence of the mountains, or a change in their general course, expand into immense plains, as in the southern and northwestern parts of the State, or connect with other valleys having the same or nearly the same level, or, may be, are separated from the latter only by low ridges or swells of land so inconsiderable as to present no obstacle to the building of railroads throughout the entire series. A more favorable region for the construction of railways than is offered by this system of communicating plains and valleys, especially where these improvements are required to pursue a generally northern and southern direction, could not be desired. Besides, being so nearly level, and wholly unobstructed, the soil, for the most part a dry sand, or a compact sandy loam, affords the best possible material for a road-bed, whether facility of construction or durability be considered. Upon these plains and valleys nothing of a vegetable growth is to be found larger or more formidable of removal than the wild sage, a shrub that can, as a general thing, be ploughed up with a single yoke of oxen, while their surfaces are almost entirely free from rocks, loose stones, or other obstructions. But while these valleys are, longitudinally viewed, so nearly level, they all have a slight descent from the foot of the adjacent mountains to their centres, caused by the wash that, going on for years, has been gradually wearing down the mountains and filling up the valleys. The difference in altitude between the tops of the mountains and the level of the valleys, now varying from 1,000 to 8,000 feet, was formerly much greater, since at one time the bottoms of the opposing mountains met, no doubt, in the middle of the intervening valley, making the difference in altitude two or three times as great as at present. While many of these valleys receive a great number of small streams from the mountains on either side, or about their heads, very few of them have any large stream flowing through the centre, the most of these tributaries sinking into the arid and porous soil as soon as they reach the edge of the valley. As a consequence, the latter, few of them having any common outlet, are great natural reservoirs; but the water, resting upon the bed rock, can only be reached by penetrating the immense mass of superincumbent debris. Hence wells in these valleys require to be sunk to a great depth, nor is water always obtained even then; though it could no doubt be reached in many places by artesian boring, a method not generally adopted, if in any instance yet resorted to in this State. In the few cases where there is a sufficient accumulation of water to cause a stream to run through the valley above ground, there are usually at points along it, patches of alluvial bottom constituting good plough or grass lands, the quantity generally being in proportion to the size of the stream. Reese river, Carson, Umashaw, Paradise, and Franklin valleys, afford good examples of this kind. In Ruby, Big Smoky, Degroot, and Toquima, we have examples of large valleys containing much good land, yet without open streams running through them; while in the Great Salt, Fairview, Ralston, Sinkavata, and Sand Spring valleys, there is neither arable land nor running water. In the case of the Big Smoky and similar valleys, the mountain streams after disappearing make their way underground towards their centres, where, meeting with obstructions, or gathering into natural basins, they saturate the earth and render it productive. Much of the soil, both in the valleys and upon the mountains, is rich and friable, being easily tilled and abounding in the elements of fruitfulness, but unavailable for agricultural purposes because of its aridity and the lack of means for its irrigation. Both the open plains and the more contracted valleys are, for the most part, destitute of timber, the only exceptions being where they are traversed by considerable streams, as the valleys of the Carson, Walker, Truckee, and Humboldt rivers, along which are a few scattered cottonwoods and copse of willow, there being no other trees, large or small, along them. Both the valleys, plains, and mountains are, in some sections of the country, wholly destitute of wood, and but ill supplied with grass and water, the latter, where it does occur, being often so impregnated with mineral substances as to render it unwholesome, or so warm as to be unfit for immediate use. Several of the more extended of these plains are so arid and barren as to justly merit the appellation of "desert," popularly applied to them. The regions most strongly marked in this respect are those adjacent to the sinks of the Humboldt and Carson, the vicinity of the Big Mud lakes, and the belt of country stretching from the Great Salt valley of Churchill county south through the centre of the State, and spreading out in the desolate and sandy wastes that surround Death valley and the sink of the Amargosa, reputed to be depressed many feet below the level of the sea. The characterizing of these sections, however, as peculiarly sterile does not imply that there are not many other considerable tracts in the State almost equally worthless, the only difference being in their more contracted area. To this system of mountains, valleys, and plains, the latter so spread out, and often connected together, as to constitute a series of basins, each having a drainage of its own, but no outlet to the sea, Nevada is indebted for its singular hydrography, this common receptacle of its gathered waters becoming, according to circumstances, a lake, sink, meadow, alkali flat, or a salt bed.

SINKS, SLOUGHS AND LAKES.—The only waters of Nevada that are supposed to reach the ocean consist of a few inconsiderable streams in the northern, and a still smaller number in the southern part of the State. The former are tributaries of the Owyhie and the Snake rivers, and the latter of the Colorado. With these exceptions all the surface flow of the country is collected in lakes, none of them of large size and most of them extremely shallow, and in *sinks*, a name popularly applied to a certain class of these lakes from the circumstance that the streams emptying into them or received from other lakes are here supposed to sink and finally disappear beneath the surface. The idea, however, is erroneous, as these bodies of water, while they are not deep, are quite as permanent as any other, though fluctuating in area with the size of the streams by which they are fed. Most of the mountain streams in this State do sink, as already stated, as soon as they reach the plains or valleys. Some of the larger streams flowing through the latter, as Reese river, also disappear in like manner, being absorbed by the earth without accumulating at any point in a lake. These are the only cases to which the term *sink* properly applies. The fact that some of these lakes having no visible outlet receive each a large stream without overflowing its banks, or being greatly raised even when these tributaries are at high stages of water, has led to the supposition that they communicate with the sea, or perhaps with subterranean lakes, through underground passages. The consideration, however, that but comparatively little rain or snow ever falls in this region, while the extreme dryness of the atmosphere and the soil causes evaporation and absorption to go on rapidly, dispenses in a great measure with the necessity for such a theory. The only lakes of any considerable size in Nevada are those formed by the Humboldt, Walker, Carson and Franklin rivers, and bearing the names of these streams respectively, together with Pyramid lake, the largest of the group, formed by the waters of Truckee river. To Lake Tahoe, lying one-third within its limits, Nevada can only advance a corresponding claim. By the the early emigrants the name *Sink* was given to Humboldt lake, and a large shallow lake situate in the northern part of Churchill county is still called the

Sink of the Carson, from the fact that it receives the surplus waters of that river through a sluggish tortuous stream, in some places having numerous channels, and in this country generally designated a *slough*. There is also a slough running from Humboldt lake to this sink, through which the former, at high stages, discharges its water. Through a similar channel Pyramid lake, when above its ordinary level, sends its water into Winnemucca lake, a large shallow basin lying east of Pyramid, and at certain seasons of the year nearly dry. In addition to the above there are small lakes and ponds in Degroot, Franklin, and various valleys in the State, the waters of which are in some cases fresh and pellucid, while in others they are more or less opaque and impure. About these ponds, which are mostly shallow, there is often a body of good grazing or agricultural land. Lake Tahoe, which has a depth of over 1,500 feet, is of an irregular oval shape, 21 miles long and 10 miles wide, and, though elevated more than 6,000 feet above the level of the sea, it never freezes over, nor does the temperature of the water vary much from 57° winter or summer, a circumstance owing, probably, to its being fed largely by springs. That it receives most of its supplies from this source is evident from the fact that it has but one tributary stream of any magnitude, while its outlet, Truckee river, carries a heavy body of water. This lake, like Pyramid, abounds in trout of large size and fine flavor, and is surrounded on every side by lofty mountains, which, rising abruptly from its shores, are covered for nearly two-thirds of the year with snow. These mountains are heavily timbered with forests of pine, spruce and fir. Pyramid lake, the largest body of water wholly within the limits of the State, is about 30 miles long and 12 wide, and is situate in the southern part of Roop county, near the western line of the State. This lake, which derives its name from a pyramidal rock standing near its centre and rising 600 feet above its surface, has an elevation of about 4,000 feet above tide level. Like the Walker, it has a considerable depth, and the scenery about it is extremely grand, it being walled round with precipitous mountains rising from 2,000 to 3,000 feet high. Walker lake has about the same altitude and length, but is not so wide as Pyramid, its average width not being over six or seven miles. Like the latter it is of an irregular oblong shape. The shores are indented with numerous small bays. Besides an inferior species of fish it contains the salmon trout; but the latter are not so large, numerous or well flavored as in Pyramid or Lake Tahoe, the water here being neither so deep nor pure. Walker lake is flanked on both sides by high mountains and rugged hills, the whole extremely arid and barren, almost entirely destitute of wood, grass or water. Carson lake has a diameter of about 12 miles; Humbold and Franklin are somewhat smaller. They are all of an irregular circular or oval shape, have low, flat shores, and are nowhere over 50 or 60 feet deep. They contain no fish except suckers and others of an inferior kind, the water of these, as well as most of the other small lakes and ponds in the country, being brackish and slightly alkaline—that of Humboldt lake and Carson sink so much so as to render the fish quite unpalatable and hardly fit for culinary purposes. The same is true of the water in most of the sloughs, and also in some of the rivers, especially the Humboldt, which becomes greatly deteriorated at its lower stages, particularly as it approaches the lake. Washoe, Toshepah, Pueblo and Guano are all small and shallow lakes, the water of which is in some cases clear and sweet, while in others it is discolored with earthy matter, or so impregnated with salt, soda or other substances as to render it distasteful if not unwholesome. About some of these lakes, as well as along a few of the rivers, occur patches of tule lands, or ground overflowed at high water and covered with a species of large-sized bulrush. Where susceptible of easy drainage, these patches can readily be converted into excellent meadows. The most extensive tracts of this land are found at the mouth of the Humboldt river, around Carson lake and sink, and above Genoa on Carson river, along the west shore of Franklin, and at the outlet of Washoe lake, smaller patches being met with at the sinks of the Umashaw, Weatherlow, and Wemissa creeks, Humboldt county, and around several small lakes in Franklin valley, Lander county.

As Honey, Mono and Owens lakes, though not within the boundaries of Nevada, all lie west of the Sierra, and form a part of the system of valleys and lakes stretching along the western rim of the Great Basin, the first two being very near the line of this State, it may be proper to give here a passing description of them. Honey Lake, so named from the honey-dew abundantly precipitated throughout this region during the summer months, is a small and very shallow body of water, even at high stages, and wholly disappears in extremely dry seasons. Its principal confluents, Willow creek and Susan river, sink into the tule marsh before reaching the lake, the shores of which are in some places low and swampy, while in others they are dry and elevated. It has no outlet, and is destitute of fish, the water being strongly alkaline. To the west of the lake is an extensive valley, skirted by the Sierra Nevada in that direction, a strip of hilly country separating it from Pyramid and Mud lakes on the east. Mono lake, lying about 10 miles southwest of the dividing line between California and Nevada, derives its name from the tribe of Indians originally inhabiting the vicinity. It is about 14 miles long and 9 wide, and, though never sounded, is supposed from the configuration of the adjacent mountains to be very deep; some trials said to have been made with a 300-foot line failed to reach bottom. It has been suggested that the bed of this lake is the centre of an extinct volcano filled up with water, a hypothesis that assumes plausibility from the crater-like form of one of its islands, as well as of numerous small mountains in the neighborhood. By chemical analysis a gallon of this water weighing eight pounds is found to contain 1,200 grains of solid matter consisting principally of chloride of sodium, (common salt,) carbonate of soda, borax, sulphate of soda, (glauber salt,) and silica, with indications of the presence of sulphuretted hydrogen. Holding such a large percentage of these substances in solution the water of this lake is, of course, so acid and nauseating as to render it not only unfit for drinking but even for bathing.* Leather immersed in it is soon destroyed by its corrosive properties, and no animal, not even a fish or frog, can for more than a short time exist in it. The wild fowl in visiting it keep about the mouths of the creeks, where the lake water is mixed with that flowing from the mountains. The only thing able to live within or upon the waters of this lake is a species of fly, which, springing from a larvæ bred in its bosom, after an ephemeral life, dies, and collecting on the surface, is drifted to the shore, where the remains collect in great quantities, to be fed upon by the ducks or gathered by the Indians, with whom this forms a staple comestible. Nestling under the eastern water-shed of the Sierra, this lake receives several considerable tributaries; and, although destitute of any outlet, such is the aridity of the atmosphere that it is always kept at nearly the same level by the process of evaporation. So dense and sluggish is the water rendered through supersaturation with various salts and other foreign matters, that none but the strongest winds can raise a ripple on its surface. As the Sierra in this neighborhood reaches nearly its greatest altitude, the scenery about Mono is varied and majestic, some portions of it being at the same time marked by a most cheerless and desolate aspect. This lake may aptly be termed a dead sea, its bitter and fatal waters rendering it literally such, while all its surroundings—wild, gloomy and foreboding—are highly suggestive of sterility and death. Owen's lake, lying to the south of Mono, though somewhat larger and not so deep, does not otherwise differ materially from the latter. It has the Sierra on the west for a back ground, while its water is almost equally saline and bitter. Like Mono, it has no outlet; and, though receiving the waters of Owen's river, a large and rapid stream, its surface is observed to be every year getting lower, a process that its former shore-line marks indicate to have been going on for a long time. This subsiding for the last five years has been at the rate of nearly two feet per year. Former beach lines along the shores of Mono lake indicate that it has in like manner fallen by gradual stages many feet below its ancient level. The larvæ generating the insect found on Mono lake also breed abundantly in these waters, being the only form of animal life adapted to live in or about them. The decomposing action of this water is shown by its effect upon the bodies of a company of Indians, some 20 or 30 in number, who, while seeking to escape the whites several years ago, having taken refuge in the lake, were there shot by their pursuers, who left them in the water. In the course of a few weeks not a vestige of their bodies was to be seen, even the bones having been decomposed by this powerful solvent.

ALKALI FLATS AND MUD LAKES.—The surface of many of the plains and valleys in this State being composed of a stiff clay nearly impervious to water, and at the same time quite level or but slightly basin-shaped, are readily converted, during wet weather, into shallow lakes, some of which exist but for a few days, while others last until the dry season comes on, a few sometimes continuing throughout the year. These bodies of water, though often covering a large area, are rarely more than a foot or two deep. When drying up they usually leave behind a slight deposit of argillacious sediment, to which circumstance and their generally miry condition they are indebted for the name *mud lake*, commonly applied to them. When covered with water, or even but moderately wet, these spots are mostly impassable to teams or even horsemen. To obviate this difficulty roads require to be thrown up and impacted by travel during the dry season. Besides this clayey sediment many of these lakes on drying up deposit a variety of salts, the most of them of alkaline nature, whence the name alkali flat given them when in this condition. These salts are white, and glisten in the sun, so that these localities are very hot in summer as well as trying to the eyes of persons crossing them. When dry their beds become so hard that the hoof of an animal or even the tire of loaded wagons leaves but a slight impression. In some instances while the greater portions of these flats become dry and hard, others remain moist, the water in places coming to within a few inches of the surface. From these damp spots a constant efflorescence of saline matter goes on. The sublimated particles are left upon the surface or adhere to the shrubbery if there be any near by. The most of these desiccated lakes, however, are wholly without vegetation, not even the artemesia being able to take root upon them. These spots, so transformed alternately into mud lakes and alkali flats, are also the localities of the salt beds and marshes characteristic of this country. Though met with in nearly every part of Nevada, the most extensive occur in the northwestern, central and southern portions of the State, where, in the wet season, some of them cover more than a hundred square miles.

RIVERS AND STREAMS.—In proportion to its size Nevada has, perhaps, fewer large streams than any other State or Territory in the Union; none of those within its limits being navigable, and not more than four or five justly entitled to be called rivers. The Humboldt, the largest and longest river in the State, is at ordinary stages fordable at many places, as are all the others nearly everywhere along them. But, while possessing so few rivers, this State contains a great number of small streams, which, issuing from the various mountain ranges, afford an extensive propulsive power and means of irrigation. As a general thing the rivers have a swift current, with occasional rapids, though nothing like a cataract exists in any part of the State. The most of the mountain streams have a great descent, some of them falling a thousand feet every two or three miles. Where running through valleys or plains, the immediate banks of the streams are apt to be low; in the case of the smaller ones only a few feet above the water, though some have higher benches further back. Reese river, for example, flowing through a channel having nearly parallel banks, is scarcely anywhere more than 10 or 15 feet below the adjacent plain. Except towards its terminus it never dries up, and rarely ever overflows its banks. At one point it disappears for several miles, having no channel above ground. The water here is diffused throughout the soil, forming, by a system of natural irrigation, an extensive meadow. Below this it reappears at several points, and being finally collected again in one channel flows on as before. This stream has an average width of 15 feet and a depth of about two feet. After pursuing its course for more than a hundred miles it begins to diminish, standing only in pools, and finally disappearing altogether. During high stages of water it runs for a greater distance, making its way nearly to the Humboldt, where it terminates in a tule swamp, which dries up in one summer. Weatherlow, Wamissa, Umashaw, and several other considerable creeks in the State resemble Reese river in their leading features. The most of them in like manner terminate in small fens, usually called *sinks*. Nearly all the running waters of the Nevada are palatable and wholesome. That of the mountain streams is always excellent. In most of the sloughs it is disagreeably brackish, which is also the case in the Humboldt river, and some other of the larger streams, particularly at low stages of water, the impurities increasing as the stream descends. In consequence of waste from evaporation and absorption most of the larger streams lose as much water from these causes as they gain from their tributaries, rendering them sometimes larger near their sources than at points further down. The Humboldt, for instance, a stream about 40 yards wide and four feet deep, is scarcely so large where it enters the lake as it is 200 miles above. The Walker and Carson rivers are also smaller where they empty into their respective lakes than at points higher up. The Truckee, though not so large, being a more rapid stream, discharges a greater volume of water throughout the year than the Humboldt. In point of size, Walker river ranks next to the Truckee. Carson river has an average width of 20 yards, with a depth of three feet, and is about two-thirds the size of Walker. Franklin river is a much smaller stream than Carson. The entire length of the Humboldt, including its two main forks, is over 300 miles. That of the others is much less. Both the Humboldt, Carson, and Walker rivers are formed by the union of two main forks or branches, below which none of them have a single affluent of any size, the Walker none whatever. Truckee river, issuing a large stream from Lake Tahoe, receives a number of tributaries before leaving the mountains, after which, though not enlarged by any affluents, it preserves a nearly uniform volume, running with a swift current until it empties into Pyramid lake. The water of this stream is cold and pure throughout its entire course, and, as it has a great descent, it could be made to supply an immense propulsive power. That it will be largely diverted to this use, as soon as the Central Pacific railroad is completed, admits of no doubt, since this improvement follows along its banks for more than 50 miles, nearly half the distance through heavy forests of spruce and pine, which supply, in connection with the extensive water power, great advantages for the manufacture of lumber. The Humboldt river takes its rise in the Goose Creek mountains, in the northwestern corner of the State, whence, running in a westerly course about 250 miles, it deflects to the south, and flowing 50 miles farther falls into Humboldt lake. It runs through a tortuous channel with a moderate current, falling about 500 feet while traversing a distance of 250 miles. It passes through an exceedingly dry and sterile country. The only good land is comprised in a narrow belt of alluvion along its immediate banks. While this belt contracts at some points to very narrow limits, or disappears altogether, it expands at a few others, as at Lassen's meadows, into grassy bottoms of considerable extent. During the period of high water, which occurs on the melting of the snow in the mountains about its sources, in the months of April, May, and June, the river is swollen to a size somewhat larger than above stated, occasionally overflowing its banks, while at low water it shrinks into smaller dimensions, a condition common to most of the other large streams in the State. The only tree found in the valley of the Humboldt is a species of small willow, growing on the banks of the stream. Nothing but a little scrubby juniper and pine, and these very sparsely, is met with upon any of the mountains adjacent. In the Goose Creek range, however, about its head waters, there are some groves of large-sized timber, with fair supplies of bunch grass and water. The grass along the river bank consists of several wild varieties, such as wire, rye, blue, clover, and bunch, some of which are so injurious to stock that experienced drovers will not allow their cattle to feed upon them, but drive them into the mountains, where the grass, though less abundant, is more nutritious and wholesome. The only fish found in this stream, or the lake into which it discharges, are minnows, of little value. During the summer the Humboldt swarms with mosquitoes, gnats, sandflies and other troublesome insects. These pests are very numerous along the lower portions of the river and about the lake.

In their leading features and surroundings the Truckee, Carson, and Walker rivers do not, except as to size, differ materially from the Humboldt, having first a narrow and partially fertile valley near their immediate banks, with another much more extensive, but wholly barren, lying somewhat higher and stretching away to the base of the mountain ranges that bound them on either hand. The cottonwoods that once formed a narrow fringe, or stood in small clumps along these streams, have mostly been cut down, and there is little left except a willow copse to mark the meanderings of the rivers through the plains, or their passage through the deep cañons that sometimes occur along their routes. These cañons, by subdividing the main valley into different parts, sometimes cause the waters of the same river to be designated by separate names. After leaving the mountains from which they all take their rise, there is, with the exception of a little willow and the few cottonwoods mentioned, no timber along any of the streams in this State or in the valleys through which they flow. In Reese River valley, proper, more than 100 miles long, there is not a stick of timber large enough for a fence rail, and nearly all the other valleys and plains in the country are equally destitute of timber.

THE SPRINGS OF NEVADA.—These abound in many parts of the State, and are to the economist not more objects of value on account of their utility than of interest to the scientist because of their size, temperature, modes of occurrence, chemical properties, and other natural peculiarities. They are met with at all altitudes, and often under such strange conditions as justly entitle them to be considered geological curiosities. They are found on the mountain sides, in the valleys, and far out on the desert—large, small, deep, shallow, cold, hot, and tepid. Some are in a state of ebullition, leaping up with a gurgling sound, as if heated by fierce fires below, while others are quiescent. Some are pellucid and perfectly pure, while others are impregnated with a great variety of mineral and metallic substances. In some places they occur solitary and at others in groups, as many as a hundred being found within an area of a few acres. In temperature they range from 50 to 204 degrees, the latter about the boiling point of water in this region. In diameter they vary from 1 to 100 feet, and in depth from 3 or 4 to 150. In shape they incline to be circular, many of them being perfectly round, with funnel-shaped or perpendicular well-like walls. The mineral and thermal springs are generally situated on a mound formed from the silicious or calcareous particles brought up and deposited by their own waters. Some of these mounds cover several acres and reach a height of 50 or 60 feet, or even more. In some cases the walls of the springs are formed of these limy or silicious concretions, which, shaped into huge basins, lift them several feet above the level of the mounds, while in others they are composed simply of earth or turf. The water in most of them is soft and palatable when cold, and so clear that the smallest object can be seen at a great depth, even the minute orifices through which the water enters at the bottom of the deepest spring being visible. Frequently a hot and a cold spring are in such proximity that a person can dip one hand into each at the same time. From some a small, and from a few quite a large, stream of water issues, while in others the water merely keeps even with the top, or does not rise so high. Some of these springs emit an odor of sulphuretted hydrogen, and taste slightly of sulphur, while others have a chalybeate taste. Analytical tests of the waters from the more highly mineralized of these springs show them to contain, in various proportions, the chlorides of sodium and magnesium, with soda in different forms and a small percentage of lime, sulphur, silica iron, and organic matter. A few of these have an intermitting or tidal action, the water coming to the surface with a gurgling sound and sinking away every few minutes, this subsidence sometimes continuing for a much longer period —occasionally for weeks, or perhaps months. The mounds and orifices of ancient thermals are frequently met with, being now destitute of water, a condition to which many seem rapidly, and perhaps all are gradually, approaching.

These fountains, both mineral and thermal, are much frequented by the Indians for their supposed medicinal virtues; and that some of them do possess valuable curative properties has been abundantly shown by the benefits conferred through their use upon multitudes of invalids who, during the past few years, have had recourse to them. Some of the cold springs, especially those in the larger valleys, are quite as limpid as the thermals, while they are often not only larger and deeper, but also freer from mineral substances than the latter. It frequently happens that the mountain streams, after sinking, reappear in the form of springs near the margin or out in the middle of the valleys; and while some of these are small or of but moderate size, others are immense pools, being from 10 to 100 feet in diameter, and often 100 feet or more in depth, some of them sending off large streams of water. Not all the cold springs, however, are free from distasteful and deleterious matters, some being so repulsive that even animals, though suffering from thirst, refuse to drink from them.

The most remarkable group of thermals in this State is that known as the Steamboat Springs, so called because, when first discovered, they are said to have emitted a puffing noise something like that of a high-pressure steamboat. The only sound escaping from them at present is a seething, gurgling noise like that of a boiling caldron. These springs are situated in Washoe county, about 16 miles north of Carson City and four east from the Sierra, near a range of low basaltic hills, an extensive flow of this rock overlying granite. They occupy a rocky mound about half a mile long and a quarter of a mile wide, having an elevation of 50 or 60 feet above the adjacent valley. This mound, which is composed wholly of silicious matter deposited by the waters, is rent longitudinally by a number of irregular, scraggy-edged fissures, from six inches to a foot in width, caused, apparently, by some upheaving force from below. Gurgling up through these chasms, which probably extend to the bottom of the mound, come, at intervals of a few minutes, volumes of hot water, which, after hissing and foaming for a minute or two, subside, leaving the aperture again nearly empty. From some of these openings small jets of steam constantly escape, accompanied with the emission of gas. Besides these fissures there are pools filled with hot water, one of which, occupying a basin three feet in diameter and one foot high, built up by the deposition of solid matter held in solution by the water, rises and falls with great regularity every six minutes. For about five minutes the water left in the bottom of this basin remains quiescent, when it gradually rises, the ebullition increasing until it runs over the rim, when it again subsides, the agitation lasting a little over a minute. By throwing a few ounces of soap into this basin the water, after rising and falling a few times, as usual, begins to boil with fury, throwing up the spray six or eight feet and sending off volumes of steam. In this manner its action can for hours be preternaturally excited, with varying degrees of energy, until it finally comes to rest, the water disappearing entirely from the basin, and not rising again for some time, as if exhausted by these vehement exertions. The temperature of the hottest of these springs is 204° Fahrenheit, this being about the boiling point of water at that altitude. The temperature of others, however, is much lower. The air about the spot smells of sulphur, the ground in the vicinity being in places impregnated with that mineral. Along the eastern base of the tumulus on which the springs are situated flows a rivulet pure and cool, till it mingles with the warm and mineralized water of the latter. At times the chemical agents at work here seem more active than at others, the sounds emitted being louder and more frequent and the steam more abundant. It is even probable that a gradual but general subsidence of action is going on, as the loud puffing sounds said to have been observed here when the springs were first discovered, some 20 years ago, are no longer heard. The country about also affords evidence that the springs in this neighborhood were formerly much more extensive than at present.

Other groups of warm springs, scarcely less remarkable, besides many less worthy of note than that above described, are met with in different parts of the State. In the valley of the Great Salt Bed, southern part of Humboldt county, occur three clusters of thermals, separated by a distance of six or eight miles—one on each side and one in the centre of the valley—but all so much alike that a description of one will serve to give a good idea of the others. The principal group at this place, being that in the centre of the valley, consisting of over 20 springs, occupies an oblong mound covering 10 acres and rising 60 feet above the level of the valley. This mound, formed wholly by the carbonate of lime brought up and deposited by the waters, is covered with short, coarse grass. Some of the springs are fringed with rushes and tules. Much of the surface is saturated with water from the overflow of the springs. This overflow runs in small channels out upon the plains, where it is soon evaporated or absorbed by the dry and porous earth. Upon the summit and about the sides of this tumulus are situated the springs, some occupying well-shaped openings in the turf and others issuing from huge basins composed of limy concretions resembling alabaster, or from the tops of tumuli formed of the same material and raised six or eight feet above the surface of the mound. Some of these springs, or rather pools, are more than 60 feet wide, while the diameter of others is not more than two or three feet, the whole varying as much in depth as in superficial area. There is also a wide difference in temperature, some being at boiling point while others are simply tepid or quite cool, the hot and cold springs in some instances being separated only by a few feet. The water in all is soft, pure, and limpid, and so transparent that the smallest object can be seen at a depth of 50 or 60 feet. Bubbles of gas are seen constantly ascending through it, but there is no ebullition nor perceptible escape of steam. While all these springs keep quite or nearly full but few overflow, the aggregate amount of water discharged being small. The cluster of springs on the west side of the valley contains eight pools, hot, warm, and cold, the most of them larger and deeper than those in the central group, while those on the eastern side, though equally numerous, are not so large. At Wilson's ranch, in the southern end of the valley, are a number of small springs, some of them quite hot, while along its eastern side are to be seen the crater-shaped basins and tumuli of extinct thermals.

At the following additional localities in this State hot springs occur, either isolated or in groups, and of different dimensions, some large and in a state of active ebullition, others small and wholly quiescent: at several points in Carson and Eagle valleys; on the desert between Truckee river and Humboldt; in the vicinity of Black Rock, very numerous; along the eastern base of the Pine Nut mountains; on the desert between the Big Bend of the Carson and Walker rivers; near Kepler's station on the Wellington road, 16 miles west of the Sinkavata mountains and 40 east of Walker's lake; at a number of places in Lassen, Alpine, and Mono counties, California, near the Nevada line; upper end of Degroot's valley, western part of Lander county; east side of Reese River valley, 60 miles north of Austin; south end of Smoky valley; in first range of mountains east of Toquima valley, and in the valley beyond; along the south side of the Upper

Humboldt, and great numbers scattered over Franklin valley, besides, in many places throughout the State, the mounds and other evidences of extinct thermals, now without signs of heat or moisture. At some of the localities enumerated the springs are large, deep, and numerous, the water being kept at a high temperature and in a state of violent commotion by internal heat; at others these conditions are nearly all reversed, the orifices, once apparently much deeper, being nearly filled up and the temperature of the water scarcely above blood heat, justifying the conclusion that the cooling process is general, and that the chemical action upon which it is dependent for its elevated temperature is constantly diminishing, and will, in process of time, cease altogether. There are cases, however, in which this action is supposed to be on the increase and in which the springs appear to be of recent origin, not being contained in the usual rocky basins nor surrounded with the mounds formed by the deposition of silicious or calcareous matter. Of this kind are the springs situate in the Hot Creek districts, Nye county, the surplus water of which is so copious and hot as to have given the name Hot creek to the stream issuing from them. Besides this there are other hot creeks in the State, having their origin in a similar cause.

Some of the cold springs in Nevada are scarcely less remarkable because of their size, depth, or the great volume of water they discharge than the thermals above described. The most noted of these occur in the central and eastern part of the State. Along the western side of Smoky valley are a number of pools, varying in diameter from 20 to 80 feet, some of them being at least 100 feet deep—so deep, in fact, that the water, which is soft and clear as crystal, has a dark blue appearance. Several of these are filled with small fish and send off a large stream of water. So immense are some of these fountains that it has been conjectured they must have their sources in subterranean lakes; a more plausible theory, however, is that they originate from the mountain streams which, sinking on the margin of the valley, pursue their way under ground until they meet with some obstruction, when they collect in reservoirs that ultimately find an outlet in these springs. In the second tier of valleys east of Smoky occurs another group of these springs, also circular in form, very deep and full of clear cold water, but having no apparent outlets or inlets. These also swarm with small fish, the number of which leads to the belief that there must be more room for them beneath the turf-like sod by which they are surrounded. In one of the lateral valleys on the Upper Humboldt is a meadow covering 1,200 acres and clothed with luxuriant grass, in the midst of which are several hundred circular openings, from three to six feet wide, through which the pure, pellucid water rises nearly to the surface. They are very deep and full of small fish, the number of which becomes greatly increased on shaking the surrounding turf, which can easily be done by the weight of the person, favoring the supposition that these apertures are really the vent holes of an extensive underground lake. Franklin river, a good-sized stream, is formed almost wholly from tributaries that take their rise in a series of large springs ranged along the base of the mountains bounding its valley on the west. Some of these springs send off creeks 15 feet wide and over a foot deep, which run with a rapid current. The number of springs contained in Thousand Springs valley, on the Upper Humboldt, is sufficiently indicated by its name; many of these are distinguished for their size and the excellence of their water.

SALT BEDS.—These deposits, through their extent and number, become not only a notable feature in the chorography, but also an important item in the economical resources of Nevada. Like the alkali flats and mud lakes they are confined to the valleys and plains, in which they cover the points of greatest depression, the most of them being adjacent to or encompassed by a belt of alkali lands. They are doubtless of lacustrine origin, occupying what were formerly the basins of inland seas and salt lakes, their deposition being effected through the evaporation of these bodies of water. Besides the extensive beds of this mineral occurring in Churchill, Esmeralda, and Lincoln counties, there are several smaller deposits, as well as a number of saliniferous springs, elsewhere in the State, all of which may become of local value on account of their proximity to supposed valuable mines. The most productive bed at present is that of the Sand Spring Salt Mining Company, 75 miles east of Virginia. The claim of this company, consisting of 1,600 acres, occupies a depression in the southeastern corner of an extensive alkali flat, the centre of which for a space of several hundred acres is damp and marshy, and some portion of it covered with a few inches of water. This damp surface is coated to a depth of two or three inches with a crystallized incrustation of salt formed by sublimation of the particles of this mineral with which the clayey strata below are charged. On removing this coating of salt a thin body of fine white clay is exposed, overlying a stratum of soft black clay, which, in turn, rests upon another seam of green and black clay, containing coarse globules of salt. Beneath this seam occurs a deposit of crystallized salt, hard and massive but of unascertained thickness. In collecting the salt at this place, a tract embracing a score of acres or more is selected, and divided into strips, from each of which, in regular order, it is scraped into large heaps with a broad wooden hoe. These heaps, after being exposed for a few days to drain and dry, are conveyed in wheelbarrows or cars running on wooden tracks laid down for the purpose of facilitating transportation over the soft ground, and thrown upon platforms or dumps, when the salt is ready for sacking and shipment to market. After one of these surface sections has been stripped of salt, the incrustration immediately begins to reform, and so rapidly do the secretions from the saliniferous clays below proceed that a few weeks, and sometimes less, is sufficient to fully replace it, admitting of the gathering of a fresh crop at least every month. As the masses of crystallized salt underlying these clayey strata are probably inexhaustible, it would seem as if this process of replenishment might go on forever. These clays are not the primary sources of supply, though no doubt serving a useful purpose in promoting by their heat the sublimation of the saline particles as well, perhaps, as in aiding their condensation upon the surface. Large sections of the alkali flat at Sand Spring, lying outside of this company's claim, are, during the dry season, covered with a coating of salt; but it is neither so heavy nor pure as that owned by them, being rarely more than an inch thick, and largely mixed with alkaline and other foreign matters, resembling, in these particulars, the deposits in Smoky valley, and in the Cortez district, and other salt fields of limited extent elsewhere in the State. The leading features of the larger beds, however, are almost identical with those of this deposit at Sand Spring, the character of the salt and the mode of collecting it being also very much the same. Prior to 1862, all the salt used in this State was brought from San Francisco, at an average cost, laid down in Virginia, of about $150 per ton. During that year parties, having imported a herd of camels for the purpose, began packing this commodity in from the salt pools, 45 miles southeast of Walker lake, whereby the prices were somewhat reduced. The following year, the Sand Spring Company having commenced operations, the price of salt suffered a further reduction, and for the past two years this article has been delivered to the mills about Virginia at the uniform rate of $60 per ton, being considerably less than the average cost of freight from San Francisco. During the year 1866 this company disposed of about 150, and during the past year of about 250 tons of salt per month, the most of which was consumed in the mills and reduction works, a little, also, after grinding, having been used for meat-packing and culinary purposes, for which it is well adapted. The Sand Spring Company have over $100,000 invested in this business, and, though owning several large teams, hire many others to haul the product of their salt fields to market, their freight bills amounting to from $10,000 to $15,000 per week. Large as is the amount of salt they are thus enabled to deliver, the supply is scarcely equal to the demand, some of the larger mills consuming between 35 and 40 tons per month. The company, finding their salt well suited to table use, have erected a steam mill at Virginia, where considerable quantities are ground and put up for this purpose. About 40 miles north of the Sand Springs bed, also in Churchill county, is another and still larger but very similar deposit of salt. At this place there is, first, an incrustation of salt an inch or two thick overlying a stratum of blue clay 18 inches thick, filled with cubical crystals of salt, and resting upon a heavy body of these crystals free from earthy matter and reaching downward to an unknown depth. This property is also owned by a company, who have laid down a tramway for running out, a platform for receiving, and a house for storing their salt. From this locality the Humboldt mills obtain their supplies of this commodity, a little, also, having been sent to Virginia and Austin, it being extremely white and pure. In the Silver Peak district, Esmeralda county, occurs the most extensive salt field in the State, its area covering some 40 or 50 square miles, much of which is coated with a thick incrustation of the pure chloride of sodium, underlaid by seams of clay and a crystallized mass of salt of unknown thickness, as at Sand Spring and Big Salt valley. Situate near the edge of this bed are a number of saline springs, the water of which evaporating is constantly increasing the deposits of salt about them. Holes dug in the earth in this vicinity are in a short time completely filled with a solid mass of salt, deposited from the supersaturated water seeping into them. It is a curious circumstance that situated in close proximity to these pools of perfect brine are a number of springs of soft fresh water. In the Columbus district, and within half a mile of the principal mines, layers of salt interstratified with clay are found near the surface; and by removing a foot or two of earthy matter on top, the water coming in fills the excavation in the course of four or five days with a compact mass of pure white salt. North of this spot five miles are the pools from which the camel train several years since procured their loading for Virginia, and at a point 10 miles to the west is the extensive deposit known as Teal's salt marsh, and from which the mills at Aurora obtain their supplies. Besides these, there are several other salt beds of minor importance both in this vicinity and in other parts of Esmeralda county, as well as also in Owen's valley, Inyo county, California, adjoining Esmeralda on the southwest. In the Pahranagat district, southeastern part of Lincoln county, on the upper waters of the Rio Virgin, masses of crystallized salt exist in such quantities as to constitute a notable part of the mountain in which they occur. They lie in strata, are almost chemically pure, and so transparent that ordinary print can be read through blocks of this material a foot square. The salt deposits before alluded to as occurring in Smoky valley and near the Cortez district are slight and impure. The former and the more important of the two lies 40 miles south, and the latter 60 miles north of Austin. The incrustation of salt at these localities is scarcely more than half an inch thick. It is deposited as elsewhere by efflorescence, and though destitute of any heavy bodies of salt below, possesses the usual power of reproduction, renewing itself as often as removed. It is dissipated, however, by the least amount of rain, though readily reappearing on the return of dry weather. From the Smoky valley bed, where a considerable amount of salt is collected, and also some manufactured for table use, the mills about Austin, at Belmont, and those around the valley procure their needed supplies of this article. This salt is sold on the ground ready for sacking at one cent a pound, the cost of hauling it to the mills where used being about as much more. Most of the salt of Nevada as found in its natural condition is remarkably pure; samples taken from the Silver Peak and the Great Salt valley beds gave by analysis 98 per cent. chloride of sodium, that from Sand Spring giving 96 per cent. Samples from Smoky valley show by assay 909 per cent. chloride of sodium, the impurities consisting of sand and sulphate of soda—ingredients which do not appear to detract from its efficacy for amalgamating purposes, though rendering it less fit for table use. With salt in such illimitable quantities, of such excellent quality and easy procurement, there can be no question but this article, besides supplying all local demands, will be largely exported from this State whenever railroad transportation shall have been extended to it.

SECTION II.

WOODLANDS—SOURCES OF FUEL AND LUMBER SUPPLY—COAL, ETC.

The only timber in this State suited for making first-class lumber is that found on or near the eastern slope of the Sierra Nevada mountains. There are, as observed in the remarks on the central and eastern parts of the State, a few groves of spruce and white pine in that quarter; but the trees are comparatively small, and the wood for the most part soft and brittle. The prevailing tree, where there is any east of the Sierra, is the scrubby pitch pine, already described, having a low bushy trunk, from 10 to 15 inches in diameter, and from 12 to 30 feet high. Being compact and resinous, it burns freely, even when green, emitting much heat, and though worth but little for lumber, constitutes a valuable fuel. Mixed with these are a few juniper and mountain mahogany trees, equally scrubby with the piñon, though the mahogany, when dry, burns well. Some of the mountain streams are fringed with a narrow belt of willow, birch, and cherry, all slender and dwarfish, and fit at best only for fence rails or fire-wood. With so great a scarcity of large timber, the better qualities of lumber necessarily command high prices in most parts of Nevada; the rates increasing with the distance from the Sierra, the principal source of supply. Thus, while this article can be purchased at the mill for about $20 per 1,000, it costs nearly three times that amount delivered in Virginia, five times in Austin, and six or seven at Belmont. The price is proportionally increased where delivered, at points still further in the interior. This question of fuel and lumber supply is more fully elucidated in the pages relating to the working of the Comstock ores and mines.

COAL.—Although no heavy deposits of coal have yet been found in Nevada, it is too valuable an article to be overlooked in making up a summary of the mineral resources of the State.

THE WHITMAN COAL MINES—DEVELOPMENTS AND RESULTS.—The first locations of mineral coal lands and efforts at working the same were made in 1861, when parties encouraged by the outcroppings of narrow seams of lignite in the Pine Nut mountains, at a point about 12 miles northeast of Dayton, Lyon county, proceeded to form a mining district, adopting a set of laws and regulations for governing the locating and holding of claims therein. These laws were similar to those used in taking up and holding quartz lodes, but with this difference, that individual claims, instead of running longitudinally with, and being confined to a narrow space along the ledge, consisted of square plats of 40 acres each, the same requiring to be surveyed by the territorial surveyor, and to be recorded after the manner of real estate. The coal signs observable in this locality are distributed over an area of several square miles, all of which, and much more was taken up soon after the district was formed. Quite a large amount of money was subsequently expended upon these claims in the work of exploration, road building, &c. Upon the most promising, shafts were sunk to a considerable depth. Whitman, the discoverer and his associates, besides opening several short inclines, and performing other preliminary labor, ran a tunnel 175 feet in length, from the extremity of which a shaft was sunk to a depth of 100 feet. The entire outlay of this company amounted to some $8,000 or $10,000, a portion of which, however, was spent in constructing a wagon road leading from their claims to the valley of Carson river, six miles distant. The investment proved nearly a total loss. Less than 100 tons of coal was disposed of, as, indeed, scarcely more than that amount of a marketable quality was ever raised from the mines. None worth speaking of has been obtained from the other claims in the neighborhood. This coal delivered at the quartz mills or other points where required for consumption, commanded from $8 to $12 per ton, rates at which most of that of local production has since been disposed of. Numerous trials were made to test its adaptability for generating steam. The proprietors of the Sacramento quartz mill, in Gold Cañon procured such alterations in their furnace grates to be made as seemed necessary to afford ample draught, and although their mill was run upon it for a short time, its use was soon abandoned. The large percentage of non-combustible matter present, choked the draught, and prevented the production of sufficient heat for the rapid creation of steam. The attempts made to introduce this coal, and that procured from Eldorado Cañon, near by, as a domestic fuel, were somewhat more successful. Considerable quantities were obtained from the latter place for a year or two, and consumed in Virginia City and vicinity.

The geological features of the Whitman district are not such as to indicate the presence of heavy bodies of carboniferous matter. The country about the mines is dry and barren; the surface in places discloses traces of former volcanic action, and although there is here a species of coarse sandstone, the old red sandstone, and most other rocks accompanying the true coal series are absent. There is also here a shale, but like the sandstone, it evidently belongs to the pliocene age, and indicates for these coal beds a comparatively modern origin. The following strata encountered in sinking a perpendicular shaft 110 feet on the Whitman grounds, serve to exemplify the general geology of the district. The first foot passed through consisted of a clay shale, below which lay several feet of steatite, mixed with talc; next nearly one foot of bituminous lignite, underlaid with a bed of talcose slate was encountered. This slate rested upon sandstone, followed by another thin seam of lignite. Then followed in succession a stratum of slate; 30 inches of lignite, of a somewhat improved character—a narrow seam of slate; six inches of coal; various strata of sandstone alternating with thin beds of steatite, shale, and coal, the shaft terminating a thick layer of white sand. The planes of these successive strata are nearly parallel, the whole pitching at an angle of about 20°, the dip varying slightly at different points.

Other Discoveries.—Soon after the location of the Whitman mines a still heavier deposit of lignite was found 12 miles further south, in Eldorado cañon, resting in a similar geological formation. From this place several hundred tons of this material was soon afterwards taken, the most of which found a market in the neighboring towns, where it was used chiefly in stoves and grates. As a domestic fuel this coal has met with more favor than that from the Whitman mine, though unfit for furnace or forge purposes. Upon the claim of the Newcastle Company, the principal claim in Eldorado cañon, a good deal of exploratory work has been done, yet no heavy body of coal has been developed. The contents of this vein resemble the brown coal of Germany, with which they coincide in their chemical constituents. An analysis of the coal from the vein of the Newcastle Company, shews it to contain, moisture 19.65, hydro-carbonaceous matter 40.59, fixed carbon 28.31, and ash 11, with traces of sulphur and iron. The resultant from distillation is a charcoal, and not a coke, as from the English coal, which generally contains more sulphur, but less volatile matter and ash. As the Nevada coal contains but little sulphur, it would be valuable for forge use and iron works, were it not for the large percentage of volatile substances it carries, composed mainly of water, which detracts from its merits as a fuel, as well as for the generation of gas. For the latter purpose it might be made to answer by the addition of some carbonaceous material, since by this plan, as has been ascertained, it could be made to produce about 9,000 cubic feet of gas to the ton, which owing to the absence of sulphur, would posses high powers of illumination. Soon after the above discoveries further coal signs were noticed two miles southeast of Fort Churchill, where a number of thin seams of lignite crop along the steep and barren hills that abound in that neighborhood. To secure these a district was laid out, and several claims taken up, on two or three of which open cuts were run and other work done, but without establishing for them any positive value. Discoveries of coal in other parts of the State have from time to time been announced, but with two or three exceptions they do not appear to have had any substantial foundation. As early as the summer of 1860, parties excited by the finding of a black slaty substance, a few miles east of Sand Springs, took steps for securing a tract of land there, but abandoned the purpose on ascertaining the worthless nature of the material. There was a rumor prevalent some years ago of mineral coal having been found in the country to the north of the Humboldt river, but the report lacks verification. In 1864, some miners prospecting to the north of New Pass station, Churchill county, having come upon a species of obsidian possessing a cleavage and lustre similar to hard coal, for which it was ignorantly mistaken, quite an excitement supervened on its being made known in Austin. The non-combustible nature of this substance was readily established, and the interest so suddenly awakened by its discovery speedily subsided. Two years later a company of miners searching after silver lodes, picked up in the Eureka district, 60 miles east of Austin, some pieces of float coal, which on trial were found to burn freely, emiting a strong heat, and leaving but little ash. This float was not traced to its original bed, concerning which nothing is known, though the sample picked up was of a superior quality, and there is reason to hope that mines of good coal will yet be found in that quarter of the State, valuable seams having already been met with in the adjacent Territory of Utah. In the Volcano district, Esmeralda county, at a point about 80 miles easterly from Aurora, two veins of coal, the one 12 and the other 30 inches think have been discovered. They can be easily traced for several rods by the bituminous debris on the surface; are evidently of an earlier period than the lignite found elsewhere in the State, and are highly carbonized, and bear the appearance of a silicious anthracite coal mixed with calcite. The impurities in this article amount to 40 or 50 per cent,, yet it emits a strong heat, and burns almost entirely to a white ash. It has been used successfully as a substitute for charcoal by blacksmiths and assayers; that tested came from but three or four feet below the surface, to which depth only have the seams yet been opened. The fissures are well defined; have an argillaceous shale on the one side, and limestone of the Jurassic age on the other; but whether these coal measures will prove to be of greater extent or value than those at the localities already described, we have not the data to determine. They remain as yet wholly undeveloped. Should they afford even a moderate amount of fuel, their presence in a region where there is but little wood and much mineral wealth would hereafter prove important. This coal is but three or four miles from a series of copper-bearing lodes, and there are also in this district promising veins of gold and silver-bearing quartz. Outcroppings of soft coal can be traced for several miles along the foot hills of the Wassack mountains. This locality is about 25 miles north of Aurora, and four miles east of the east fork of Walker river. In thickness this seam ranges from a mere thread of shale to 6 or 7 feet. The coal burns readily. A lot taken from a shaft 30 feet below the surface underwent perfect combustion on being ignited, while lying in an open heap on the ground. The vein runs nearly northwest and southeast, and dips southwesterly at an angle of 20° degrees. The accompanying formation consists of shale, sedimentary rock, sandstone, &c., the whole having a range corresponding with that of the coal seam. The deposits at this place are not in their natural situation much exposed, and but little work has yet been done upon them. It is difficult to form an opinion as to their value, though competent judges speak favorably of the chances for finding here a fair article of soft coal. Recently a coal vein of the anthracite variety is reported to have been found 15 miles from Hiko, the county seat of Lincoln county, in this State. The vein is represented to be 15 inches thick on the surface, and its contents are said to ignite readily, and burn with freedom, leaving less than three per cent. of residuum. In gravity and external characteristics it compares favorably with the best coal found on this side of the continent, though assigned to a later geological period. Should the deposit prove at all extensive it would greatly benefit the surrounding region, which, with much mineral wealth, is rather limited in its supplies of fuel.

CRYSTAL PEAK.—At this locality, some 35 miles northwest of Virginia City, coal signs similar to those in El Dorado cañon occur in a depression known as Dog valley, lying near the eastern base of the Sierra, distant one mile from the Truckee river, and two from the line of the Central Pacific railroad. The adjacent hills, as well as the valley, are covered with a stately growth of spruce and pine timber, which, should the coal fail, might still afford profitable employment to a considerable population, as good lumber can be made here at small cost. The Truckee affords ample water-power for saw-mills to manufacture, and the railroad a ready means for transporting it to market. There are also some gold and silver-bearing lodes in the district, which, with the facilities at hand for reducing the ores, may come to be worked with remunerative results. The discovery of coal at this place was made about four years ago, fragmentary portions of a dark-colored, lustrous lignite, strongly marked with the structure of the trees and plants from which it was formed, having been found along the line of the outcropping coal seams. A good deal of work directed to the exploration of these beds has since been done. Several thousand dollars have been expended in sinking shafts and artesian borings, and in excavating cuts and tunnels. Some of the former have been carried to a depth of 300 feet. In some cases the work of prospecting was first effected by means of boring, after which working shafts were put down and steam machinery was employed to facilitate hoisting and pumping operations. The carboniferous strata at Crystal Peak vary in thickness from a few inches to two and a half feet; they are much compressed in spots, and largely intermixed with foreign matter. Although a considerable quantity of this lignite has been extracted, and one company claim to have reached, by boring, a seam eight feet thick at a point 300 feet beneath the surface, the developments made have not, in the main, proved satisfactory; and of the several enterprises at one time set on foot for the purpose of exploring these beds, none are now being actively prosecuted; and as some of those interested may contemplate resuming operations, it may be expedient to copy here the opinions of the State mineralogist of Nevada, as to the probabilities of any considerable bodies of coal, even of the lignite class, ever being found at this place. Mr. Stretch, having given the locality a personal examination, remarks concerning its geology and coal prospects as follows:

> As so much imperfect knowledge relative to the probabilities of finding coal in Nevada is prevalent, it may be well to speak more fully of the indications in this neighborhood. The seams of coal originally discovered at this place are interstratified with thin beds of coarse sandstone or volcanic tufa, of light colors. This formation is traceable easterly for a distance of 15 miles, being intimately associated with trachytes and basalt wherever it is found. Where it is exposed in Long valley, north of Virginia, it contains great numbers of fragments of willow leaves, grasses, &c., remains resembling some varieties of sage-brush, and in one instance the elytron of a beetle, apparently the same as a species now found on the same mountains, and attached to the piñon. These remains indicate for the formation a comparatively recent date, a conclusion confirmed by the manner in which it is associated with the surrounding rocks. The rocks of the Sierra at Crystal Peak are entirely igneous or metamorphic in their character, and have been tilted into every conceivable position by the agencies which seamed them with intruded granite and basalt. Did any of the formations which are known to accompany the coal fields of Europe and the eastern States occur in this vicinity, even though covered up by lava beds, their immense thickness, and the distortions to which they have been subjected, would certainly have disclosed their presence, and they might have been recognized by their peculiar fossils. They certainly do not exist at Crystal Peak. Had the tufas and sandstones containing the so-called coal seams been formed before the elevation of the Sierra,

they would have necessarily been tilted and displaced in the same manner as the associated rocks, partaking of all the flexures and faults of the mountain range near which they lie. Instead of this being the case, the stratification is nearly horizontal, or only slightly inclined. In some places the beds have been somewhat tilted, probably by the causes which finally raised them above the water level, and gave the present configuration to the surrounding country. The conclusion is almost irresistible, that whatever coal is found in the neighborhood of Crystal Peak will be confined to the small valleys in that vicinity, which, at the period when Steamboat valley was an inland sea bounded by the Sierra on the west and the Virginia mountains on the east, formed small arms of the lake, and collected more or less of the vegetable *débris* which during violent storms was washed down from the pine forests on the surrounding hills. There is yet another consideration to be taken into account in estimating the probable extent of the deposit. The loss of bulk during the conversion of vegetable matter into coal is equal to about three-fourths of the original mass. It becomes evident from this that an extensive bed of coal can only be found where there has been, at some remote period, most luxuriant forest growth and water sufficient in quantity to convey the *débris* to vast tracts of marshy ground favorable for decomposition. The coal fields of the Eastern States and England afford abundant evidence that they were at one time extensive tracts of swampy forests, with a tropical climate and a luxuriance of vegetation with which even equatorial forests in the present day cannot compete. On the other hand, the remains of plants found in the associated rocks at Crystal Peak do not warrant us in entertaining the belief that such conditions ever existed in that neighborhood. What we do find point rather to a scanty growth, such as is found on the hills to-day. The almost entire absence of animal remains in the beds strongly supports this idea. Where there is an abundant vegetation there is generally a corresponding abundance of animal life, which could scarcely have failed to leave some mementos of its existence. If these views are correct, as there is good reason to believe they are, no body of coal will be found in this vicinity which, from its extent or thickness, will repay the capital expended in its development. The mere fact of the formation having accumulated in a contracted mountain valley, limits its extent and value at the same time. The thin seams of bituminous matter found between the layers of tufa may have been the product of dense growths of tule and other water plants.

SECTION III.

COPPER.

Among the more promising cupriferous localities in the State, is

The Peavine District, situate about 30 miles northwest of Virginia City, being six miles north of the Truckee river, and about the same distance from the Central Pacific railroad, with all which it is connected by good wagon roads. This district, erected in March, 1863, has a length of about 20, and an average width of 10 or 12 miles. Near its centre is a cluster of small springs, at which a house was built in 1860. About these springs grow quantities of wild peavines, hence the name of the station and subsequently of the district, which covers a region of low hills stretching along the eastern base of the Sierra Nevada. The country about the mines is dry, barren, and treeless, though it contains several small lakes with a number of springs, and water can be obtained in many places by digging wells from 30 to 50 feet deep, while wood, both for fuel and lumber, abounds in the Sierra, four or five miles distant. The lodes in this district, found almost invariably in a granite and metamorphic formation, have a northerly and southerly strike, and are from 3 to 12 feet in thickness, with a few of greater dimensions. They do not project much above the surface, and although a small number have been traced by the outcrop for several hundred yards, and have been found persistent for a considerable depth, many of them have the appearance of segregated rather than deep fissured veins. The lodes possessing the best local reputation as based on size, assays of ore, and extent of development, are the Great Eastern, 20 feet thick, the Bevelhymer, American Eagle, Enterprise, and Metropolitan, upon which tunnels have been run, varying from 50 to 300 feet in length, and the Pacific, Indian, Occidental, Young America, Great Western, Orient, Challenge, and Bay State, all somewhat explored by means of shafts, open cuts, and other excavations. The Tolls Company have expended some

$4,000 in prospecting their lode, from which they have taken quantities of ore assaying from 15 to 40 per cent. of copper, and from $60 to $500 per ton in gold and silver. While the above-mentioned claims, as well, perhaps, as many besides, cover large and permanent lodes, others in the district have the appearance of being merely limited and superficial deposits. The Peavine ores, composed chiefly of carbonates and oxides, besides assaying largely in copper, contain a sufficiency of the precious metals to defray cost of transportation to the seaboard, when, as will be the case in the course of next year, railroad transit can be had. In the metalliferous portions of these veins free gold can frequently be detected by the unassisted eye; particles of this metal being sometimes found on the surface where the veinstone has undergone decomposition. The ores of this district give by assay from 10 to 50 per cent. of metallic copper, selected samples often going much higher. Small lots of the better class of ores have been found by working tests to yield from 30 to 40 per cent. of metal. By an assay of these ores made by Mr. Ricard, the following results were obtained:

Gold	.0005	$2 50	per ton.
Silver	.0200	7 85	"
Oxide of copper	34.1000	135 00	"
Peroxide of iron	2.3200		
Alumina	.2200		
Sulphur	1.3600		
Carbonic acid	11.2000		
Silicia	46.6600		
Water	3.8400		
Loss	.2795		
	100.0000	145 35	"

Some choice ores reduced at the English Company's mill, seven miles distant from the mines, yielded 100 ounces of silver to the ton. Smelting works on the Swansea plan, with a capacity for operating 10 or 12 tons of ore daily, have been erected in the district, plumbago, obtained from a bed of that mineral near Washoe City, having been employed in their construction. This material is abundant in the locality mentioned, and although not yet thoroughly proved, there is good reason for believing it well adapted to this and similar uses. Several other furnaces, some of them on a different plan, have been projected, and there is a likelihood that one or more of these will be completed and in operation in the course of a few months. It is probable, however, that the bulk of these ores will be shipped to San Francisco for a market, or sent elsewhere for treatment when the railroad shall have been completed to this point; an event that promises to revive operations, now nearly suspended, enhance the value of claims, and repopulate this eligibly situated and promising district. A town, also named Peavine, was laid out in 1863, at the group of springs mentioned. It contains several houses, and being adjacent to the mines, should the latter turn out according to expectation, its growth will no doubt keep pace with their future development.

THE WALKER RIVER COPPER REGION covers a considerable scope of country lying between and adjacent to the east and west forks of that stream. The principal mines, so far as developments extend, are distant from the latter in a westerly direction, from 3 to 10 miles. This cupriferous belt has an average width of eight and a length of about 25 miles. Within these limits some strong veins occur, and here most of the labor and money laid out in that region have been expended. Like the Peavine, this is an arid, sterile, and timberless district; the only water in the immediate vicinity of the mines is afforded by a few small springs, while the only vegetable products consist of a scanty growth of bunch grass, artemisia, and a few other equally scraggy and worthless shrubs. There are, however, scattered groves of piñon on the Pine Nut mountains a few miles to the west, while the west branch of Walker river, in close proximity, and at all seasons a strong and rapid stream, supplies every requisite for reduction works. The volume of water is ample for propulsive power, and also for floating down fuel and lumber from the heavy pine and spruce forests 30 miles above. The veins here, which are numerous, well defined, and of fair average dimensions, have a generally north-northeast trend, assay from 12 to 50 per cent. in copper, and from $15 to $30 per ton in the precious metals. Most of the country rock is of a calcareous nature. The ores embrace almost every variety, and often carry small particles of virgin metal. The first discoveries were made in this district in 1862, since which time a good deal of work in a promiscuous way has been done. Although several lodes have been opened to a considerable depth, it can hardly be said that any have been thoroughly explored. Active exertions, except upon a few claims, have been suspended for the past two years. On the Bewley mine an incline shaft 6 feet by 10 has been sunk to a depth of 100 feet. From this lode several hundred tons of ore have been extracted which gave an average yield of nearly 40 per cent. of metal. It is well formed, has a thickness of about six feet, has a northerly and southerly strike, and an easterly dip in conformity with the prevailing pitch in the district. Other veins located near it and partially opened, promise almost equally well. Upon the Constitution, Peacock, Ward, and Weister lodes, some prospecting work has been performed with encouraging results. The former, which is the most extensively opened, exhibits a vein 16 feet thick, and carries ores that assay from 20 to 30 per cent. of copper, with a large percentage of iron, and from $15 to $18 per ton in gold and silver. The quantity of iron diminishes as depth is attained on the lode. The Ward and Weister lode, lying near the Constitution, and some 10 miles to the westward of the river, is about six feet wide, carries a pure gray sulphuret ore of high grade with native copper, and from $25 to $30 per ton in gold and silver. The Peacock, four miles from the river, is a four-foot vein, impregnated with yellow sulphuret ore assaying about the same as that from the Constitution. In the foot hills that flank the Tollock mountains lying between the forks of Walker river, as well as in the country contiguous to the main stream and that stretching along the western base of the Wassack range west of the Walker lake, occur numerous copper-bearing lodes, which, judging from surface indications—none of them having been much opened—will yet constitute a cupriferous field of considerable extent and value. As in the district further west, a variety of ores is met with in these localities. The facilities for transportation and reduction are about the same.

In Battle Mountain district,* in the eastern part of Humboldt county, are several deposits of the red oxide of copper. The Dunderberg, the principal lode in the district, consists of a mass of silicious rock and limestone nearly 200 feet thick, permeated by numerous small veins of this ore, assaying throughout 50 per cent. of metal. Owing to the remoteness of the district, 90 miles north-northwest of Austin, and about the same distance easterly from the settled portions of Humboldt county, these deposits, though apparently rich and extensive, possess only a prospective value, since they cannot be opened to advantage or worked with profit until the railroad, to pass within 10 miles of them, shall be completed. With that auxiliary they will probably command the means necessary for development. The country about these mines, though generally barren, contains some patches of good land, with a narrow strip of fertile bottoms along the Humboldt river a few miles distant, to the north. Being without timber, however, and the other agents essential to an economical reduction of the ores, the mass of them will require to be shipped elsewhere for treatment. In the Volcano district, Esmeralda county, at a point about 80 miles northeast of Aurora, have been found some of the heaviest and apparently richest copper lodes in the State. The deposits at this place consist of well-defined veins, some of them of considerable magnitude, and of ore-bearing masses lying upon or projecting from the surface. The top ores are carbonates, with a sprinkling of other varieties, and at greater depths sulphurets, the average assays of which indicate a fair percentage of copper and the presence of from $25 to $30 per ton in silver, and from $2 to $10 in gold. The region for a considerable distance around is forbidding and desolate; it is scantily supplied with wood and water, and wholly destitute of arable lands. Moreover, it is far removed from the line of any contemplated railway, and otherwise unfavorably situated for the cheap extraction of the metals and exportation of ores; so that an early development of its mineral resources, of which copper forms but one, can hardly be anticipated. About 50 miles southeast of Volcano, in the San Antonio district, signs of copper manifest themselves over a considerable scope of country. The ores at this place are said to be rich, yet nothing has been done to indicate the extent or probable permanence of the mines. One of the ledges located here at a point two and a half miles east of Montezuma Spring, called the Ruby, has a thickness of 12 feet, and, although it carries a variety of metals, copper appears to predominate. In the Bolivia, Mammoth, and Palmetto districts, as well as in numerous other localities in different parts of the State, strong and well marked veins of copper ore occur. Although many of these bear superficial evidence of permanency, no positive opinion can be pronounced on this point, since only upon a few of them has any work been done. Upon none have explorations been prosecuted to decisive results.

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* See section on Eastern Nevada.

SECTION IV.

METEOROLOGY, BOTANY, ZOOLOGY, ETC.

Of the climate of Nevada so much has been said elsewhere that it only remains here to notice a few of what may be considered its meteorological peculiarities; among which the most remarkable are what have been denominated *cloud bursts*, a heavy precipitation of rain caused by the meeting of two clouds surcharged with moisture. This phenomenon is thought to be produced through electrical agencies, though not enough has been ascertained to settle this fully. Numbers of these "cloud bursts" occur every summer. They are most frequent in the southern and western parts of the State. In some instances an immense amount of water falls to the earth in a few minutes, filling up gulches and sweeping away everything opposed to its progress. Several lives have been lost and considerable property destroyed in the State during the past few years through this cause.

The *mirage*, an optical illusion caused by saline particles floating in a heated atmosphere, is often seen in great perfection on the deserts of Nevada. Sometimes it takes the form of lakes, with islands and headlands bathing in their limpid waters; assuming, at others, though more rarely, the appearance of extensive groves and wooded lawns, the whole so closely resembling nature that it requires an effort of reason to dispel the illusion. The same or similar atmospheric conditions sometimes so refract the rays of light as to distort and magnify in a strange manner objects seen at a short distance. A sage bush viewed through this medium has the appearance of a large spreading tree, and the little cones formed by the drifting sand loom like pyramids on the deserts.

Snow slides, though often happening in the Sierra, where they sometimes occur on a large scale and with fatal results, are not common in the interior of the State. Nearly every winter some unfortunate traveller loses his life in the Sierras by being overwhelmed by these descending masses of snow.

Sand storms and sand clouds are regular features of the climatology of this region. The former is brought about by certain strong winds, which, blowing steadily for some days, so completely fill the air with sand and dust that it is impossible to see for more than a few rods. Respiration becomes labored, and the atmosphere often grows oppressively warm during their continuance, which rarely lasts more than a single day. The sand clouds or pillars are formed after the manner of water-spouts, and consist of immense bodies of fine sand and dust carried to a great height by a rotary and upward, but at the same time advancing, current of air, sometimes at a slow and again with a rapid pace. Frequently these columns sway high in the atmosphere, and many of them can be seen at the same time following each other in majestic procession across the plains.

This region, like California, has its wet and dry seasons, though the latter is scarcely so long or uninterrupted here as there, nor is the precipitation during the wet season so great. Summer showers, accompanied with thunder and lightning, are more frequent in Nevada than in California, though much less common than in the States east of the Rocky mountains.

Both the fauna and flora of Nevada lack fullness and variety. The indigenous plants and flowers are few, while the animal kingdom, except in the department of insect life, is barren almost beyond example. With the exception of the pine-nut, a few wild currants and gooseberries, and one or two other inferior kinds of berries, found only in a few localities, and none of them very plentiful, there is little in the vegetable world that civilized man considers eatable. There are few or no wild plums, blackberries, strawberries, or grapes. The wild cherries found growing on a scrubby bush in some of the cañons are small, bitter, and astringent. The Indians find many medicinal herbs and esculent roots, but neither are much esteemed by white men. In the tulé about the sink of the Humboldt and Carson grows a species of cane which exudes a sweet sirup that, drying in small lumps on the surface, forms a tolerable article of sugar. Wild flax and tobacco are found occasionally growing on the hills, and along the Humboldt a species of wild hemp is met with, having a long and stout fibre, which may, with cultivation, come to form an important textile. The artemesia or wild sage, a scraggy shrub growing from one to six feet high, is found nearly everywhere. This species is worthless for anything except fuel, though there is a small white kind of sage upon which cattle feed with avidity after it has been visited by the first frosts of autumn. The cactus, growing but sparsely in the northern and central parts of the State, is common further south, where, also, the mesquit tree abounds. Game, with the exception of sage hen and hare, is scarce in all parts of the State. There are no wildcats, panthers, bears, or other animals that can justly be called beasts of prey. The nearest approach to these are the coyote and wolf, of which there are a few in all parts of the country. On some of the more lofty ranges are to be seen occasionally small herds of mountain sheep. These animals are shy and fleet, keeping usually in the more rugged and inaccessible parts of the mountains. The beaver, otter, martin, foxes, fishers, and other fur-bearing animals that drew the trapper into this region in the early day, have nearly all disappeared, and now rarely fall a prey to the hunter. About the sinks and lakes geese, ducks, cranes, and pelicans are, at certain seasons of the year, plentiful. These, with the sage hen, raven, an occasional eagle, and a sprinkling of small birds, comprise all there is to represent the feathered race in the country. Reptiles are also scarce, and are mostly confined to a few horned toads, spotted lizards, and snakes, of which the only venomous kind is the rattlesnake.

SECTION V.

SOCIAL, INDUSTRIAL, AND EDUCATIONAL PROGRESS.

In all these departments Nevada has made rapid and gratifying progress. Her population is distinguished for industry, order, and a ready obedience to lawful authority. Already nearly 30 church edifices have been erected in the State, at a cost ranging from $2,000 to $40,000 each, and an aggregate expense of about $300,000. These represent the leading Christian denominations, and are in some cases spacious and handsome buildings. Numerous well conducted schools have been established under an enlightened educational system, for the support of which liberal provision has been made by the State. There is also a number of academies, seminaries, and high schools sustained by private patronage. Capacious halls for literary, social, and benevolent purposes have been erected in all the large towns, several of which are supplied with gas and water works and commodious buildings for municipal uses. Besides many minor industrial establishments, several large foundries and machine shops have been erected in the vicinity of Virginia, and one, also of considerable capacity, at Austin, near the centre of the State. A salt mill, an acid factory, and a tannery and pottery speak of the diversified pursuits now obtaining a foothold, and a well-patronized press, issuing five daily and as many weekly journals, indicate the intelligence and enlightenment of the people. Of the agricultural capacities and products of the country so much has been said elsewhere in this report that they need only be glanced at in a summary way in this connection. The entire amount of land, arable and grazing, enclosed in the State may be roughly estimated at 150,000 acres, of which one-quarter at least is planted to grain, giving an average yield of about 20 bushels to 1. Nearly every cereal grown in the most favored regions elsewhere can, with proper care, be successfully grown here. Even the more delicate fruits common in the temperate zones, such as pears, peaches, and grapes, can be raised in Nevada if the soil and site be judiciously selected and their culture properly attended to, while in the matter of vegetables, except the more tender kind, no country can produce them with greater facility or of better quality if the requisite attention be paid to their culture. Besides the vegetables and grain raised in this State, large quantities of butter and cheese are annually produced, and these commodities are very justly esteemed for their excellent flavor. Taken in the aggregate, the amount of stock kept in the State is quite large; the neat cattle number between 11,000 and 12,000, and the horses and mules kept for farming purposes and draft about 6,000, besides between 3,000 and 4,000 sheep and about the same number of swine. The ranges of mountain pasturage found in many parts of the State, with an almost universal absence of weeds, burs, and wild animals to injure the wool and endanger the lives of the flock, should recommend this country to wool growers and sheep herders abroad. The tulé lands furnish a good field for raising swine. These animals thrive well on the root of that rush, even without other food. It is estimated that there were 75,000 tons of hay cut and 6,000 tons of grain raised in the State the present year, besides sufficient vegetables for home consumption. There are three flour mills, one in operation and two in course of erection; 24 saw-mills, driving 35 saws, and having a capacity to cut daily from 5,000 to 20,000 feet of lumber each, or an aggregate of 180,000 feet. The most of these mills are propelled by steam. Their cost ranges from $5,000 to $15,000; total cost, about $175,000. The number of quartz mills and reduction works in this State, including such as are in course of erection, having their machinery and material on the ground, with the prospect of an early completion, may be set down at 160. The most of these mills are driven by steam, the whole carrying an aggregate of about 1,300 stamps. The individual cost of these establishments varies from $3,000 to $950,000, the cost of the greater part ranging from $40,000 to $60,000 each, though quite a number have cost $100,000, and several much larger sums. At the present time nearly all of these establishments are in constant and profitable operation. None of those completed and in condition to do good work are idle. About 60 miles of ditching, the most of it of large capacity, has been constructed in the State for the purpose of conducting water to points where required for the use of mills or for domestic wants, besides a large amount of work expended on other projects of this kind but partially completed and a multitude of smaller ditches dug for irrigating purposes. Over 1,000 miles of toll-road, some portions of it very costly, has been built, either for subserving local necessities and wholly within the State, or for the purpose of improving thoroughfares over the Sierra, or connecting those with points in the interior. The sums expended on account of these improvements amount in the aggregate to scarcely less than a million of dollars

SECTION VI.

DOUGLAS COUNTY.

This county, named after the late Stephen A. Douglas, is situate centrally on the western border of the State, having Ormsby and Lyon counties on the north, Esmeralda on the east, and California on the west and south. It has an area of about 1,500 square miles, forming in this respect the fourth county in the State, though it contains more valuable timber land than any other, except Washoe, as well as a greater quantity of good agricultural land in proportion to its size. In 1861 it contained a population of 1,057; the present population is about 2,000. The western part of this county is covered by the Sierra Nevada mountains, and the eastern by the Pine Nut range, Carson valley, embracing about 200 square miles lying between them. About one-third of this valley consists of good farming and meadow lands; the remainder consists of gravelly and sandy sage barrens, the most of it incapable of producing good grain crops, even with the aid of careful culture and irrigation. There are in this valley several thousand acres of tulé land, which by diking and drainage might be converted into valuable pasture and hay lands. With the exception of about 2,000 acres of arable land lying in Jack's valley, one mile northwest of Carson, nearly all the tillable soil in this county is embraced within the limits of the latter, or the mountain ravines tributary to it. Outside of these, Douglas county possesses a generally rugged surface and a barren soil, the latter incapable, except where covered with forests, of producing anything beyond its native growth, the artemesia, and a scanty crop of bunch grass. Much of the soil on the hills and mountains would grow fair crops of grain could it be irrigated, but for this there are, unfortunately, but limited facilities. Carson river, flowing centrally through the valley, together with the numerous streams coming down from the Sierra, afford, to a certain extent, means for irrigation and for the propulsion of machinery. To the latter use a sufficiency of it has been diverted for driving the machinery of six saw mills and one flour mill, without more than partially appropriating the power that could be obtained. These mills, including also a steam mill situated in the western part of the country, cost in the aggregate about $40,000, and have a united capacity for cutting 50,000 feet of lumber per day. The timber lands, from which a good article of lumber can be made, amount to between 60,000 and 70,000 acres within the limits of the county. This timber is situate on the Sierra Nevada. The Pine Nut range contains only scattered groves of piñon, the greater portion of it is destitute of even this. There are no quartz mills in this county. As yet no productive mines have been developed within its boundaries. Agriculture, hay making, and stock ranching constitute the principal pursuits of its inhabitants; the number of work horses and mules contained in it being estimated at 800; the neat cattle at 1,800, and the swine at 400. Much poultry is also kept by the farmers, and considerable quantities of butter and cheese are made annually. The amount of hay cut here in 1866 reached 15,000 tons; the grain raised was estimated at 570 tons. Thirty thousanda acres of land have been enclosed, of which between 6,000 and 7,000 are under cultivation. Douglas is well supplied with wagon roads. The extensive valley occupying its centre, and the numerous mountain passes leading out of it, favor their construction. Genoa, the county seat and only town in the county of considerable size, contains about 400 inhabitants. Besides a brick school-house and two churches, it contains a handsome court-house erected at a cost of $20,000. The value of taxable property in the country is estimated at $600,000. There are numerous hot springs situate in and along the margin of Carson valley, but none of them are of a magnitude or possessed of other features requiring special notice.

While, as observed, no mines have been developed to a productive state in this county, it is believed to contain some valuable cupriferous, if not also argentiferous, lodes, upon some of which a large amount of exploratory labor has been expended. Commencing in 1859, several mining districts have since been laid out in the county, the earlier with a view to operations on silver-bearing lodes; one or two, more recently erected in the eastern part of the county, for the purpose of securing and working the copper veins existing at that point. These latter districts, and one or two others, are all that still maintain their organization. The rest, created under excitement and insufficient exploration, have long since been abandoned. For fuller information touching these cupriferous lodes the article on copper may be consulted. The Eagle district, situate on the Pine Nut range in the southern part of the county, contains a number of quartz veins, some of them displaying prominent outcrops. In the work of exploring two of these ledges, the Peck and the Mammoth, a thousand feet of tunneling has been run. Operations, commenced in 1860, were continuously prosecuted for four or five years thereafter, and although the ledge has been penetrated in these claims at a considerable depth, no paying body of ore has been developed. It is said the work, for some time suspended, is to be resumed. Already about $100,000 have been expended upon these two claims, from neither of which has any amount of millable ore been extracted. Adjoining Douglas on the south are situate Markleyville, Mogul, Monitor, Silver Mountain, and several other less important districts, all silver-producing and lying east of the Sierra, though in Alpine county, California. They are located on the head-waters of Carson river, distant from 20 to 40 miles from Genoa. In the vicinity of the latter place is a district bearing the same name and stretching along the base of the Sierra, in which a good many claims were located about six years ago. Here afterwards a large amount of work was done and money expended, but with no very determinate results. The outlay at this point, divided among some ten or twelve companies, could scarcely have been less than $200,000, over 3,000 linear feet of tunnelling having been excavated, besides other work done. For the past year or two operations have been suspended, and, as is generally supposed, with no prospect of an early resumption. Could a heavy body of moderately rich ore be found at this spot it could hardly fail to impart value to these mines, owing to the cheapness with which it could be worked by reason of their proximity to wood and water. The prospect, however, of reaching even this result is not encouraging. In a range of low hills at the north end of Carson valley some small veins of gold and silver-bearing quartz were found about a year ago. Upon these several shafts have been sunk, and in the limited operations conducted at this place is to be found nearly all the work now being done upon mines within the bounds of this county.

SECTION VII.

ORMSBY COUNTY.

This county, which adjoins Douglas on the north, takes its name from William Ormsby, an early settler on the eastern slope and one of the founders of Carson City. Though of small dimensions, devoid of productive mines, and containing but a moderate amount of arable land, its central and otherwise eligible situation, extensive pineries, and ample water power have built up within it important industries, rendering the population among the most thrifty in the State. Carson City is the capital of the State, and has been selected for the site of the United States branch mint. The census report of 1861 showed the county to contain 2,076 inhabitants, a number now increased to about 2,500, of whom two-thirds perhaps reside in Carson City, and a sixth in Empire, a milling hamlet, situate on the river three miles east of Carson. A large proportion of the inhabitants are engaged in teaming, lumbering, and cutting fire-wood. Three-fourths of the county is covered with mountains. The Sierra occupies the western and the Pine Nut range the eastern parts. These mountains are here timbered as in Douglas county, and the broad and sandy plain, fertile only in its western part, known as Eagle valley, lies between them. Across from south to north runs the Carson river, affording good water-power and an easy channel for floating down saw-logs and fuel from the forests about the head-waters of this stream. The quantity of these materials thus brought down to Empire amounts to 5,000,000 feet lumber and 5,000 cords of wood annually. The streams issuing from the Sierra also supply a considerable amount of propulsive power, besides furnishing Carson City with water for domestic uses, and the arable land about it, of which there are several thousand acres, with means for irrigation, nearly the whole of this water having thus been utilized. A considerable amount of lumber is made in this county. The forests of pine and fir with water power in their midst, and the proximity of the Comstock mines, insure a constant market and supply many advantages for carrying on the business. The wood lands consist of about 20,000 acres of large timber, situate in the Sierra, and 2,000 or 3,000 acres of scattered piñon fit only for fuel. About 2,000,000 feet of lumber and 14,000 cords of wood are annually cut within the limits of the county, besides that floated down the Carson. There are three saw-mills in the county, built at an aggregate cost of $30,000; daily capacity 40,000 feet. About 6,000 acres of land are under fence, of which 200 are sown to grain and 100 planted with vegetables. Last year 200 tons of hay were cut and 180 tons of grain raised, 25 of wheat, 50 of oats, and 105 of barley, the average yield being nearly 40 bushels per acre. This is about the proportion in which these several kinds of grain are raised throughout the State, though this yield is much above the average. The county contains 430 horses and mules, 700 head of neat cattle, 200 of which are milch cows and 450 work oxen, 250 sheep, and 500 swine. A tannery and acid works at Carson City, with sandstone quarries near by, together with lime and charcoal burning, and the several pursuits already mentioned, give to this county a more varied industry than is common elsewhere in the State. The acid works have engaged in the manufacture of sulphuric acid, an article employed in the beneficiating of silver ore, with fair prospects of success. About 2,000 pounds of sulphur, procured from the beds in Humboldt county, are consumed here weekly. The sandstone quarries yield a good article of building material. It is easily gotten out and is readily shaped by the chisel when first quarried, but hardens on exposure to the atmosphere. The United States branch mint is constructed of this stone, as are also the penitentiary, county buildings, used for State purposes, and many of the better class of edifices in Carson City. Near the town are two large hot springs, one of which has been handsomely improved for bathing purposes. Five miles to the northeast is a bed of white marble, very pure and easily wrought. Granular limestone is found at several places. Copper, iron, and coal are among the mineral products of Ormsby, as elsewhere related. There are eight quartz mills in this county, five driven by water and three by water and steam; the whole carrying 175 stamps and costing $450,000. They are all kept running on ores from the Comstock vein. The Mexican, one of the largest of the number, has been engaged for some time past in working over the sulphurets which for several years had been accumulating in the company's reservoir.

Although numerous mining districts have been laid off in this county, some as early as 1859, and a large amount of work done on a few of the ledges located, no mineral deposits of value have been reached, nor has much attention been paid to the business of mining for the past few years. In the Eagle district, the earliest erected, lying along the base of the Sierra west of Carson City, several lodes were located in 1859, some of which having been extensively prospected the following year by means of shafts and tunnels, and not turning out according to expectation, the whole was abandoned. The next season a fitful interest was awakened in regard to supposed valuable discoveries made on the bald hills southwest of the town, which having led to the locating of many claims in that neighborhood, eventuated, soon after, in their total abandonment, since which time nothing further has been done either towards locating or working mines in the district. The same year the Clear Creek district was the scene of much excitement and activity. Extensive mining grounds were taken up and prospecting operations initiated. Here a number of long tunnels were afterwards driven and deep shafts sunk, but none of them availed to reach ore deposits of a remunerative kind, and the district, under an absence of population and an entire cessation of labor for several years, is considered practically abandoned. In the Sullivan district, east of Carson river, organized in 1860, there were many locations made and much desultory work done during that and the following year; and although some of the lodes proved highly auriferous in spots, they failed, so far as penetrated, in the matter of persistence and regularity. Another drawback upon the success of these mines was at that time experienced in the absence of mills for working the ores, which were, therefore, unavailable, compelling claimholders who were without means to suspend work, leaving the problem as to the character and value of these lodes still unsolved. The ores in most of these districts carry considerable copper, and in some cases a notable percentage of free gold. Washings for the latter metal have been found remunerative at several localities in the county. At a spot three miles west of Carson sluicing operations were for some time carried on, having been in progress until recently. Although no regular vein was found, the surface earth gave fair returns in free gold.

SECTION VIII.

WASHOE COUNTY.

This county takes its name from the tribe of aborigines who formerly inhabited this part of the State. It lies north of Ormsby; its western portion covers a large and well timbered section of the Sierra, and its central a chain of fertile valleys, of which Washoe, Pleasant, Steamboat, Truckee and Long are the principal. With the exception of these valleys, which contain about 150,000 acres of farming and grass lands and the timber lands mentioned, nearly the entire county consists of sage plains, rugged hills and mountains. The most of it is arid, barren, and unfit for cultivation, the only vegetable growth found upon it being a sparse crop of bunch grass, and in a few spots groves of scrubby pine. The valleys, however, are extremely fertile, and with careful cultivation and irrigation are made to produce hay, grain and vegetables. Considerable quantities of butter and cheese are also made. At the south end of Washoe valley is situated a shallow lake five miles long and two wide, the surplus waters of which run through a slough and are made to do service in driving several quartz mills at Washoe City, a few miles below. The numerous streams falling from the Sierra are also employed for propelling quartz and saw mills located along them. Pleasant valley, a small but fertile basin, lies two miles north of Washoe. Steamboat valley, the site of the hot springs elsewhere described, lies three miles north of Pleasant valley. It contains some good land, opening eight miles below the hot springs into the Truckee meadows, a tract embracing several thousand acres of partly arable and grass lands. The population of this county numbers about 3,000. It contains several small towns, of which Ophir, situate near the mill and reduction works of the Ophir Company, has 500, and Washoe City, the county seat, three miles further north, 800. Franktown, Galena, Crystal Peak, and Glendale—the latter two on the Truckee—are small agricultural and mining hamlets containing from 100 to 200 inhabitants each.

While the wealth of the county consists largely of its agricultural resources, the business of lumbering and quartz milling is also extensively engaged in. The annual product of hay amounts to about 7,000 tons, and of grain to 1,500 tons. There are 800 horses and mules and 1,000 head of neat cattle in the county, nearly half of the latter being milch cows; sheep and swine number about 500 each. There are 20,000 acres of land enclosed, of which 4,000 are under cultivation. There are 15 saw-mills, most of them driven by steam power; the whole cut about 1,300,000 feet of lumber per month, besides lath and shingles, for making which several of them have machines attached. In addition to this, 400,000 feet of hewn timber and large quantities of cord wood are cut for the Virginia market. Although this county, like Douglas and Ormsby, is without productive mines, there are ten quartz mills within its limits, several of which are large and first-class in their appointments. The Ophir Company's mill carries 72 stamps and cost half a million of dollars. Dall's mill at Franktown, burnt last spring but since rebuilt, carries 60 stamps and cost a quarter of a million. Most of these mills are propelled by steam; several employ both steam and water. They carry, in the aggregate, 281 stamps, and cost $1,420,000. With the exception of the English Company's mill on the Truckee, built in advance of mining developments, all these establishments are now running on Comstock ores, and generally with remunerative results.

The amount of taxable property in the county, in 1861, was $1,140,000; in 1863, $2,527,500, and is now believed to be at least $3,000,000. There have been 30 miles of canal built for conducting water to mills and other enterprises of this kind projected, some of which may be carried out. Although abounding in metalliferous lodes and mineral deposits of different kinds, the county is still without ore-yielding mines, a circumstance attributable, in the case of gold and silver-bearing lodes, partially to the barrenness of the latter in their upper portions, and in part to the superficial and ill-directed character of prospecting labors. Of the deposits of copper and coal, mention has been made elsewhere. A number of mining districts have at various times been formed, some of them as early as 1859, the year of the silver discovery. In the spring of 1860 the Argentine district, lying in the range of mountains east of Washoe valley, was erected; and although the ledges there have periodically since been the subjects of sanguine expectation, the ore procured from them has done little towards meeting the expenses incurred in their partial development. Scarcely any work has been done in the district for the last three years, and the lodes can hardly be said to possess any present value. The history of this, the first district formed, will serve to illustrate that of all others subsequently erected, in every one of which the high hopes at one time entertained failed of final realization. Of the many claims located throughout the county nearly all may be considered abandoned, nor is it probable that work will ever be resumed on more than a few of them. The quartz veins, though of fair size, are generally hard and vitreous, the country rock being mostly metamorphic slate and granite. The ores are usually impregnated with compounds of iron and copper, carrying also, in some cases, a small percentage of sulphuretted silver, with particles of native metal and a sprinkling of free gold. So much of the latter has been found in the earth at several points as to afford fair surface digging for a short time. In the Wisconsin district, at the south end of Washoe valley, several companies made wages for a period of some months, sluice-washing the auriferous ground at that place. The Galena district, as its name implies, abounds in the sulphuret of lead, which here occurs in the shape of an argentiferous galena. The metal extracted from it assays about $200 per ton in silver. The vein matter carries from 20 to 60 per cent. of metallic lead. Between the walls of the veins and the gangue rests a thin stratum of arsenical pyrites, so placed, however, as to render their mechanical separation easy. Upon several of these lodes work has been done. The Alford has been explored by means of a tunnel several hundred feet long and an incline shaft sunk at its terminus. Various attempts have been made to reduce this ore by smelting, none of which have met with entire success. The principal lode having lately passed into the hands of a company possessed of ample means and the requisite skill, better results, it is believed, will be reached through the efforts now about to be made for smelting it on a large scale. The Silver Peak district, besides the beds of lignite there found, contains a number of metalliferous lodes, some of which prospect well in the precious metals. The facilities enjoyed through the forests and water power at that place will secure the working of low grade ores with profit, if only the quantity be large and easily procured. A lot of ore taken from the Truckee Ophir, a large ledge and the only one yet much opened, was found to yield by mill process at the rate of $30 per ton in gold and silver. A town has been laid out near these mines which, as it is within two miles of the Truckee river and the Central Pacific railroad, and surrounded with forests, has the promise of growth. Several saw-mills in the vicinity already find market for all the lumber they can make, and, with the railroad completed, quantities of this article will probably be manufactured at this point.

SECTION IX.

STOREY COUNTY.

This county, named in honor of Captain Storey, who lost his life in the Indian fight near Pyramid lake, in the spring of 1860, is not only of limited extent but extremely barren, containing a smaller amount of good land, less timber, and fewer streams than any other in the State. It is, in fact, without agricultural, lumbering, or even milling resources, except in the latter case where some have been supplied by steam. The only pasturage is that afforded by the bunch-grass—short-lived and scanty at best, since there is little of it except on the mountains, and when once eaten off does not readily grow up again the same season. Originally there was a sparse growth of piñon on the hills about Virginia, but it is now nearly all cut away, leaving both the town and the mills dependent on outside localities for fuel. Nearly all the northern and western part of the county, embracing fully three-fourths of its area, lies on the high and barren chain of mountains known as the Washoe range, and which, commencing near Carson City, extends to the Truckee river, forming a sort of spur or off-shoot of the main Sierra. Situated along the eastern slope of this range, about half-way up its side, and running parallel with its longitudinal axis, is the Comstock lode, with Virginia City built immediately over it, and Gold Hill, half a mile further south, a little below the line of its strike.* The eastern part of the county is composed of the desolate sage barren stretching from the Carson north to the Truckee river—a treeless, arid and sandy waste, alike destitute of vegetable and animal life. Storey, like all its sister counties, has been the theatre of numerous mining excitements, leading to the creation and sudden peopling of new districts to be almost as suddenly abandoned and soon after forgotten. In this manner at least a dozen districts have first and last been formed, scarcely any of which continue to maintain their organization or are recognized as having a legal existence. Still there are a number of districts in the county besides those of Virginia and Gold Hill that continue to be recognized as valid, and in some of which, as the American Flat and Flowery, there is much work being done, and in a few instances with satisfactory results or good prospects of ultimate success. The amount of land enclosed by fence does not exceed 5,000 acres in the county, of which 1,000, perhaps, are under cultivation, a good share of it being planted with vegetables, which in a few choice localities are found to do well. Some attempts at raising fruit in a small way have also been attended with success. About 100 tons of hay are cut yearly in the county, but as yet no grain has been raised. Storey contains about 1,000 head of work-horses and mules, 500 neat cattle—one-half of them milch cows—100 sheep and 400 swine. An immense number of beef cattle, sheep and hogs are slaughtered here annually, the most of which are driven in from California. For its size there is a great extent of costly toll road in this county, several hundred thousand dollars having been laid out in this class of improvements, some of which return large revenues to the owners. The assessable property in the county amounted for 1866 to $6,343,353, the estimate for the present year being about $7,000,000. Storey county contains 63 quartz mills carrying 665 stamps, all, except two or three of small capacity, driven by steam, the aggregate cost of the whole being $3,500,000. The population, which in 1861 reached 4,500, is now estimated at 12,000.

SECTION X.

LYON COUNTY.

Lyon county, named after General Lyon, who fell in Missouri during the late rebellion, bears a strong resemblance in its general features to Storey, except that it contains a considerable tract of piñon on the Pine Nut range, occupying the eastern part of the county, and a belt of good land situate along the Carson river running through the centre. A multitude of ledges have been located in the various mining districts formed from time to time within the limits of this county, the money expended upon which has amounted in the aggregate to millions of dollars; yet, with the exception of the Daney mine and some small lodes along Gold cañon, nothing affording a steady supply of pay ore has been developed in the county, though there are unquestionably many lodes that a more persistent mode of exploration might have brought to a paying point. The only districts in the county that continue to maintain an organization are the Devil's Gate, the earliest formed, the Blue Sulphur Spring, Brown's Indian Spring, and Palmyra, in none of which has much active mining been carried on for the past three years. Of the coal deposits situated in the Pine Nut mountains a description will be found in the article treating of that mineral. In the absence of productive mines, milling, teaming and wood-chopping have become the leading pursuits of the inhabitants, very little attention being paid to agriculture, as, indeed, there is but little arable land in the county. The hay cut amounts to about 1,000 tons annually; the grain raised to 100 tons; a good many vegetables of fine quality being also raised. Lyon contains 500 horses and mules, 200 head of neat cattle, 100 sheep, and 150 swine. About 5,000 acres of land is fenced in, of which 1,500 is under cultivation. The inhabitants, numbering 1,650 in 1861, are now estimated at 2,500. There are 41 quartz mills in the county—13 driven by water, 22 by steam, and six by water and steam—the whole carrying 600 stamps and costing $1,500,000. The only considerable towns in the county are Silver City in Gold cañon, and Dayton on Carson river, each containing about 1,200 inhabitants.

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* See Section XVI, on the Comstock lode.

SECTION XI.

ROOP COUNTY.

This county, occupying a long and narrow strip of territory in the northwestern part of the State, is named after Isaac N. Roop, an early settler in Honey Lake Valley, and at one time governor of the Provisional Territory of Nevada. It was at first called Lake, having been changed to Roop in 1862. The county has never been organized, but is attached to Washoe for judicial and political purposes. At the time it was first erected, in 1861, it was supposed to embrace within its limits Honey Lake valley, the only settlement in it. The adjustment of the boundary line between Nevada and California, in 1863, having thrown this valley into the latter, left this county almost without population. The settlement since then of Surprise Valley, in the extreme northwestern part of the State, has brought within the boundaries of Roop a population of several hundred, a number which is likely soon to be further augmented, as the county is reputed to be rich in mineral wealth, and there are known to be considerable tracts of good land in the northern part still open for occupation. This region, including also the northern and western parts of Humboldt county, has for a long time been infested by a vicious race of Indians, whose presence has tended greatly to retard its exploration and settlement; but as these savages are now pretty well subdued, the country is likely in a short time to become more thoroughly prospected and its value for mining and agricultural purposes more fully ascertained. The greater portion of it is undoubtedly very barren and forbidding, consisting for the most part of rough, arid, and timberless mountains, or equally dry and sterile plains. All accounts, however, agree in representing Surprise valley as being extensive and fertile, and one of the finest districts, both for stock-raising and grain growing, in the State. This valley, a portion of which lies in California, is 50 miles long and from 10 to 15 broad. It extends north and south; contains three lakes which cover nearly one half its area. It is walled in on the west by a lofty spur of the Sierra Nevada, having a range of low rolling hills on the east. The mountains on the west are well timbered with white and yellow pine, and along their lower slopes with cedar. The arable land lies along the base of this range and between it and the lakes, having a gentle declivity towards the latter, and is covered at all seasons of the year with a luxuriant growth of blue-joint, clover, timothy and rye grass, some of which is six and seven feet high, and standing so close that in places four tons of hay can be cut to the acre. Across this alluvial belt, which is several miles wide, course every few miles streams of pure cold water, affording propulsive power and the facilities for irrigation. The land is light, warm, and easily cultivated, and produces with little trouble prolific crops of grain. The planting of 1866 yielded an average of 50 bushels of wheat and nearly 60 of barley to the acre. The grain is clean and heavy. This year the crops, under more extensive planting, have been equally good. Vegetables can be grown with very little care. The climate of this valley is mild and healthful. Very little snow falls in winter, and sickness amongst the inhabitants is of rare occurrence. Stock require neither shelter nor fodder in the winter, but are able to keep fat the year round on the native grasses. There are at the present time about 10,000 head of cattle, and 3,000 horses grazing here, many of which having been driven in from California for the purpose of being recruited, will, as soon as they become fat, be taken away. The population numbers about 250, and is constantly increasing, as the settlers feel safe under the military protection now extended to them, against further Indian depredations. Along the base of the mountain on the west side of the valley are a multitude of warm springs, some of them remarkable for their depth and volume. Free gold has been found in small quantities on several streams in this part of the country, and there is reason for believing that both vein mining and surface digging will yet be carried on here with profit. With a mining population to consume the products of the farmer, this region could scarcely fail to fill up rapidly with a hardy and prosperous people.

SECTION XII.

HUMBOLDT COUNTY.

This county, named after the principal river running through it, ranks among the larger counties of the State. Its western half is covered with sandy deserts, low ranges of monutains, isolated hills, and extensive alkali flats, converted in the wet season into mud lakes. The northern and eastern portions consist of lofty chains of mountains, broken towards the northeast into irregular masses, and running in the southeast in narrow parallel ranges separated by valleys of a similar conformation. Taken as a whole the region is dry, desolate, and but illy supplied with grass and water. Timber is also very scarce in most parts of this county, there being none fit for lumber. The only trees found here are the piñon and a scrubby species of juniper, the latter of little value even for fuel. The quantity of agricultural land is also comparatively small, being confined mostly to the valleys of the Humboldt river and of Weniessa, Umashaw, and Weatherlow creeks, with some isolated spots of good soil in the larger valleys and at the entrance to the mountain cañons. Bunch grass is found nearly everywhere except on the alkali flats and arid deserts, though in many places it is much scattered and far from abundant. High basaltic table lands cut by fissure-like chasms, constitute a feature in the northwestern part of the county. In many of these depressions, which have precipitous sides varying from 200 to 1,000 feet high, are small alkali lakes, the beds of which become perfectly white on drying up in summer, from the depositions of magnesia, salt, and soda left behind. To the south of this region occur in their greatest extent the mud lakes peculiar to the geography of Nevada, in the midst of which is situated the Black Rock mining district, the Pueblo and Vicksburg districts, the only ones in this part of the State, lying further north and very near the Oregon line. Humboldt county contained, August, 1861, about 400 inhabitants. The present population is estimated at between 1,200 and 1,300, not so many by one-half as it was four years ago, a falling off due to the great disadvantanges under which the mines here have to be opened rather than to the poverty of the mines themselves. Among these disadvantages the lack of timber, and in some localities of even wood for fuel, and the cost of freights stand foremost. When the Pacific railroad, striking through the very heart of the Humboldt mining region, shall have been completed, thereby obviating in some measure these difficulties, this section must receive an impulse that will awaken the energies of the inhabitants and restore the confidence once felt in the district. It is estimated that there are 200,000 acres of arable land in the county, much of which is now a natural meadow, being covered with a coarse species of grass, and all of which could, with irrigation, be made to produce crops of grain or the cultivated grasses. Without artificial moisture but little of the soil is capable of maturing either grain or vegetables, though with its aid both can be grown. There is nearly everywhere pasturage enough both winter and summer for a small amount of stock, or for a large amount if the latter be sufficiently scattered. The stock is estimated at 500 head of horses and mules, 400 head of neat cattle, 200 sheep, and 300 swine. There are 15,000 acres of land enclosed, 4,000 under cultivation; 3,000 tons of hay are cut, and 1,000 tons of grain raised annually, the most of them in Humboldt and Paradise valleys, the latter embracing between 20,000 and 30,000 acres of well-watered and fertile farming land. Here a number of settlers have located during the past three years, nearly all of whom are doing a thrifty business raising grain and vegetables, or in cutting hay for the Humboldt and Owyhee markets, or for supplying the military post established in the valley. The yield of the cereals here is prolific, both grain and vegetables being grown without much trouble. Even the wild rye on being cultivated produces a large and plump berry. The barley sown on sod freshly turned up yielded last year at the rate of 23 bushels to one, and of 1,100 acres of barley, and 1,300 of wheat grown in the valley the present year, the yield has been equally good. Barley delivered on the farms sells at the rate of about $2 50 per bushel, and wheat at about the same, though the price of the latter will now probably depreciate, as a flour mill is about being erected in the valley. The quantity of grain raised here in 1866 amounted to 33,000 bushels, the crop the present season being still larger. So green does the grass remain, and so genial is the climate in this valley, that good hay can be made in the month of December. The principal towns in the county are Unionville, the county seat, with a population of 400, Star city, 300, and Humboldt city, 100; besides which there are several mining hamlets numbering from 40 to 60 inhabitants. Some of these towns contain a number of fine buildings, which being erected at a time when labor and material were very expensive, have cost large sums. The most noteworthy improvement in the county is the Humboldt canal, designed to take water from the river and introduce it into or near the mines, and now in course of construction. This work is more than half finished, and will, when completed, be 80 miles long, 15 feet wide, and 3 feet deep, carrying water sufficient to drive at least 600 stamps. It will cost, construction of dam included, a little over $1,000 per mile. The route of this canal lies near many of the best mines in the county, and must, when these come to be developed, prove a very valuable and important property in a country having so little fuel for generating steam power. Already this work has been rendered to some extent available for the propulsion of machinery. There are 12 quartz mills in the county, two of them provided with furnaces for smelting the ores, the whole number carrying 112 stamps and costing $400,000. Of these mills, nine are propelled by steam and three by water. The power for driving one of these mills recently constructed is obtained by damming up the outlet of Humboldt lake, by which means a sufficient force is generated for carrying a large number of stamps, and which it is intended shall be applied to that purpose should the ores of the Desert district, on which the present mill is to be run, prove remunerating. Many of the ores in this region are so mixed with lead, antimony, copper, and other refractory agents as to require smelting, for which purpose several establishments have already been erected and are in operation. Two of these, the one situated at Etna, and the other at Oreana, on the Humboldt river, have, after many difficulties, succeeded to such an extent that the business is now remunerative, the shipments of bullion from them amounting to $3,000 per week.

The crude metal turned out by smelting consists of lead, silver, and antimony, which is then passed through calcining and refining furnaces, whereby the silver is liberated from the base metals, coming out from $\frac{995}{1000}$ to $\frac{997}{1000}$ fine. Much of the crude metal is sent away, as it will not pay for refining here where the expenses are so high. The cost of smelting and refining ore at these establishments is $50 per ton, about double the cost of reduction here by ordinary mill process. The price of wood delivered at the mills varies from $6 to $14 per cord, depending on localities. The extraction of the ores costs about $10 per ton; hauling to mill from $3 to $8, according to distance. Some of the lodes in this region carry in the outcrop chiefly gold, while others contain only silver or both of these metals mixed. Many of the smaller ledges are rich in free gold, and are worked as gold mines. This is especially the case in the Oro Fino. Sierra, and other districts in the mountains, designated as the Foist Range east. While some of the lodes in this county are large, well walled and symetrical, carrying all the features of regular fissure veins, others are narrow and broken and marked by irregular distributions of ore. An immense amount of work has been done in this part of the country, but there has been too little concentration of labor and much of it has been lost. Some of the tunnels have a length varying from 500 to 2,000 feet, showing that a great deal of persistent work has been done. Yet only in a few cases have these excavations reached the lodes for which they were driven, so that not much practical benefit has been reaped from their construction. Besides these tunnels a great number of shafts have been sunk, being the more common method of prospecting claims here. These shafts vary in depth from a few feet to several hundred, some of them being carried down on and following the inclination of the vein. Most of the companies have in this manner been able to bring small lots of pay ore to the surface, while others, drifting upon thin lodes, have raised considerable quantities. The ore is usually of high grade, yielding by mill process from $40 to $200 per ton, and in some cases much more. That taken from the Sheba mine several years since, yielded from $200 to $500 per ton, the average being $140. With so large a number of veins, some of them carrying a good body of high grade ores and displaying evidence of permanency, this can hardly fail to become in the course of a few years a productive mining district. Prior to 1867 the annual shipments of bullion from Humboldt scarcely exceeded $200,000, whereas the amount will be nearly double that sum for the present year, with the prospect of a larger increase hereafter. Much prospecting as well as exploratory labor is now being done in different parts of the county, and generally with encouraging results. Capital is being invested more freely than for several years past, a number of new mills are being put up and others projected, while population that had for some time been falling off is again on the increase. In the northwestern part of the county adjacent to a fertile and well-watered valley, is situated the Pueblo district, with the Vicksburg district a short distance further south. There are good mines here, but the remoteness of the locality, and the hostile disposition of the Indians there have retarded their development as well as prevented the settlement of the country. The only mill ever erected in Pueblo was burnt by the savages, who at the same time murdered two of the early settlers of the district and wounded others. With the adoption of more vigorous measures for the prevention of these outrages there is a probability that operations, for several years nearly suspended, will be resumed at both Vicksburg and Pueblo. This valley, in its general features, resembles Surprise valley, already described, only that it is more extensive, though not so much settled. The Black Rock mines are situated in the western part of the county, some 40 miles south of the Vicksburg district. The region about there is sterile in the extreme, being almost without any arable or meadow land, and very deficient in wood, grass, and water. But that the mines at this place are extensive and valuable is now beyond dispute, though for a long time the peculiar appearance of the ore, in the absence of developments and working tests, rendered this a matter of considerable doubt. Recent crushings of ore, claimed to represent average masses in these mines, have tended to dispel doubts of their richness, if indeed they may not be said to have established for them a high value. The deposits here lie in huge masses rather than arranged in ore channels walled in the ordinary way, and should they be found persistent in depth, must prove valuable, notwithstanding the remoteness of their locality and their unfavorable surroundings.

SECTION XIII.

CHURCHILL COUNTY.

This county took its name from Fort Churchill, the first military post ever established in this region, so called after an officer in the United States army. The entire western half, except near the waters of the Carson, is a sandy sage barren, the most of it an absolute desert, over which are scattered low ranges of black basaltic hills. Across the central and eastern portions run in a north and south direction three high ranges of mountains, the Silver Hill the most westerly, Clan Alpine the centre, and the See-da-yah or Look-out chain on the east, each separated from the other by a broad and generally barren valley. The county contains in proportion to its size but little good land, the amount fit for hay-cutting or grain-raising not being over 50,000 acres in an area of nearly 6,000 square miles. This good land is nearly all found along the Carson river, or about the lake, slough and sink formed by its waters, the greater portion consisting of natural meadows, kept for cutting hay. On the mountains there is a scanty growth of bunch grass; elsewhere almost none at all. The mountains also contain all the wood there is in the county, and nearly all the water except that supplied by Carson river. About 2,500 tons of hay are cut, and 300 tons of grain, with as many vegetables, are raised annually. There are 400 horses and mules in the county, and 600 cattle, one-half of them work oxen. The population numbers about 400, of whom 150 are residents of La Plata, the county seat. Besides its auriferous veins, Churchill contains a variety of minerals and metals, its western portion, owing to its great depression, being a vast receptacle of the various salts distilled from the drainage of more than half the State. The sink of the Carson may be considered the grand central basin of all northern and western Nevada; hence, about it we find deposited those alkaline, saline, and sulphurous substances with which most of the waters of this State are impregnated. From the waters of two small lakes situated in the great desert plain west of Carson sink, the carbonate of soda is so abundantly deposited that tons of the article could easily be collected quite pure. One of these, on drying up, which it does every summer, leaves a thick incrustation of this salt behind. Sulphur and the chloride of soda are also plentiful; and two of the principal salt beds in the State are in the western part of this county. Hot springs occur at several places with many tumuli and other signs of extinct thermals. In the article on *sinks and sloughs* will be found some remarks on these hydrographical features of Churchill county. Some 10 or 12 mining districts have at different periods been laid out within the bounds of this county. Silver Hill, situated in the mountains of the same name, and organized in 1860, contains some large lodes heavily charged with auriferous and argentiferous galena, a number of which have been prospected. Considerable work has been done in the district. Its inconvenient situation, however, joined with a scarcity of water, as well as a prospective scarcity of wood, has served to defeat all efforts for getting in mills or otherwise bringing the ledges to a productive state. Very little work has been done here for the past three years, and latterly there have been but few inhabitants in the district. Desert district is located in the northwestern corner of the county on what is known as the Forty-Mile desert. It is an arid dreary timberless plain, being without even a sufficiency of water for culinary uses. The lodes are small and blind, but rich in free gold, which occurs in a gangue, composed principally of red oxide of iron, easily reduced; and if there were only the ordinary facilities for working these mines they might prove very remunerative. A five-stamp mill was built near them four years ago, and though operated for a time with success has since remained idle, the difficulty of getting wood and water supplies proving too great. A mill has been built lately at the outlet of Humboldt for working these ores, and though distant some 14 miles from the mines, the enterprise may turn out profitable, and as there is a considerable amount of propulsive power at that point, these lodes may yet be worked extensively. In the Mountain Wall district, situate on the eastern slope of the Silver Hill range, a great many veins were located some five years ago. The surface indications being good, considerable work was afterwards done upon them. But the lodes were found to be faulty and uncertain, which led to the abandonment of most of them. Experts are of opinion that deeper exploration would reach permanent bodies of pay ore in these mines. Three years ago the Silver Wave Company completed at La Plata a 20-stamp mill, at a cost of $125,000. They had, however, failed to prove their mine in advance, and it having failed to furnish sufficient pay ore, the mill after running for a short time was obliged to stop, and has been idle ever since. About the same time another company, supplied as in the case above, with eastern funds, erected at Averill, a few miles from La Plata, a 20-stamp mill, at a cost of $150,000, and although this has not as yet accomplished much in the way of taking out bullion, they are developing their mines with a prospect of obtaining sufficient pay ore to start the mill and keep it running. It is by no means certain that similar persistence on the part of the Silver Wave Company in opening their ledge would not be attended with good results. With the exception of the work doing by the Averill Company there are but few mining operations now in progress in the district. The history of operations in the Mountain Well district is so like that of those in Clan Alpine, 30 miles farther east, that it is unnecessary to go into details of the latter, where also, after but a superficial examination of the mines, a 10-stamp mill was two years ago put up to run a few days, and then remain idle. Yet there are unquestionably good mines in this district, besides plenty of wood and water to insure a cheap reduction of the ores. Of the several other districts in this county nothing is required to be said other than that many of them show encouraging signs of pay ore, though but little work has been done, and most of them are but poorly supplied with wood and water.

SECTION XIV.

ESMERALDA COUNTY.

This county, named after the principal mining district in it, occupies the southwestern portion of the State. In its general features the country does not differ materially from most of that already described, except that the mountains contain a greater extent of piñon forests than those of Humboldt, Roop, or Churchill. The proportion of agricultural land, however, is scarcely greater than in those counties, if so great as in Humboldt. The mineral productions of Esmeralda are varied and abundant, the veins of gold, silver and copper being numerous, often large, and scattered over a vast region. The number of mining districts laid out in the county, first and last, is so large that it would require considerable space to repeat their names. The first discovery of silver lodes was made near Aurora, in the summer of 1860; immediately after which a large population was drawn to that vicinity, and for several years mining operations were carried on with activity. Mills were erected, and a town built up which at one time contained 3,000 inhabitants. The prices of real estate advanced to extravagant figures, and mining properties were bought and sold at rates out of all proportion to their real value. In the mean time the titles to many of the leading mining claims became involved in litigation, whereby work was for the time being suspended, and capitalists deterred from further investments. The mills, left without sufficient supplies of ore, ceased, first to pay dividends, then expenses, and finally closed up altogether. Suffering under these conjoint disasters, business fell off, the population left, stocks depreciated, and the Esmeralda mines were practically abandoned just at a time when, by proper caution and good management, they might have been rendered permanently remunerative. This occurred nearly four years ago, and although matters have been slightly improving about Aurora, the great mining centre of the county, for a year or more past, they are not yet restored to their former prosperous condition. The population of the county, which in the summer of 1861 numbered about 3,000 souls, had two years after increased to more than 4,000. At present it does not exceed 2,500. The principal part of the farming and hay lands are situated on the forks of Walker river. The following figures indicate something of the agricultural resources and products of this county: 500 horses and mules, 1,000 head of neat cattle, 300 sheep, 400 swine, 3,000 tons of hay cut, and 600 tons grain, besides a large quantity of vegetables raised, annually. There are 15,000 acres of land under fence, of which 5,000 are cultivated. The first quartz mill was erected at Aurora in 1861, since which time 15 others have been built in the county—10 at that place, one in the Columbus district, two at Silver Peak, one at Pine Creek, and one at Red Mountain. Besides these there are several in the Bodie and other districts adjacent, generally spoken of as being in Esmeralda, though really in California. These mills carry 200 stamps, all told, and will have cost, when that now in process of building at Silver Creek is completed, about $600,000. The most of those at Aurora having been put up in 1862-'63, when labor and material were high, cost considerably more than similar establishments would at present. After the building of the first mill at that place the shipments of bullion from the county steadily increased for several years, until they reached nearly $1,000,000 for 1864. From this time they fell off heavily for two years, but are now again on the increase, and there is reason to believe they will be steadily augmented for years to come. In addition to the troubles already mentioned, the millmen at Aurora experienced the further difficulty of having in some cases a rather refractory class of ores to deal with; many of the ledges, also, which had prospected fairly in the croppings, failed to yield any large bodies of ore at greater depths. In some cases the exposed portion of the ledges here, and even the quartz boulders, of which there were many lying loose on the surface of the ground, were found to be heavily charged with the sulphuret of silver. Much free gold was also found in several of the veins and occasionally in the earth adjacent, all of which leading to the belief that an abundance of pay ore could be easily and certainly obtained, a number of large and costly mills were erected in advance of mining developments, many of them to meet with subsequent embarrassment and often to remain idle for want of ore. This district also suffered severely from excessive speculation in mining stocks and properties, much of it brought about through very questionable agencies and modes of procedure, the odium of which, extending beyond the guilty instruments, attached to the mines themselves, thus discouraging the work of exploration and bringing them into disrepute. Within the past two years parties conversant with the geology of the mineral veins in this district, and well posted as to previous operations, satisfied that the principal cause of failure was to be found in the superficial and insufficient character of the explorations before carried on, have commenced a series of deep prospecting shafts on a number of the more promising ledges at Aurora, with a view to prosecuting them to determinate results. In several cases these operations have already been crowned with complete or partial success, in one, at least, that of the Juniata, a vein well charged with pay ore having been developed at no great depth beneath the surface, a circumstance that, besides encouraging those engaged in similar works to persevere, will be likely to lead to the initiation of other enterprises directed to the accomplishment of the same end. Stimulated by these results, business has begun to improve in Aurora, and mining enterprise has everywhere received a wholesome impetus throughout the county. Some of these prospecting shafts are already down several hundred feet, and, being supplied with efficient hoisting works and directed by parties of experience and energy, are progressing favorably. The ore in this district is a sulphuret of silver, much of it carrying a percentage of gold, either free or in combination with other metals and minerals. Taken as a mass, it is of high grade, yielding from one-third to one-half more bullion than that from the mines about Virginia City and Gold Hill. Most of the ore raised at Aurora yields by mill process from $40 to $70 per ton, $50 being perhaps a fair average; while the cost of reduction is, or might be, less than at those places, wood being considerably cheaper. The only trouble seems to be the insufficiency of the ore supply, and this, as above stated, may be considered in a fair way of being overcome. Wood costs, delivered at the mills in Aurora, about $6 per cord—a little less in most of the outside districts in the county—a price that cannot be materially advanced for some years to come, owing to the abundance of piñon in the vicinity of the principal mines. In the proximity of the latter to good agricultural districts a further guarantee is had against exorbitant demands for grain and many other staples of subsistence. The only towns in Esmeralda county of any size are Aurora and Pine Grove, the former, the county seat, containing a population of about 1,500, and the latter of about 300. There are two saw-mills in the county capable of cutting about 10,000 feet of lumber per day, and a large extent of toll-roads, some portions of which have been built at heavy expense. Lying in a northerly and easterly direction from Aurora, and distant from 10 to 30 miles, are several mining districts, all of which, having had their day of popularity, generally resting on misapprehension or a hasty inspection of their claims, are now nearly depopulated. Of these the Walker River, Lake, Cornell, Desert, East Esmeralda, Masonic, and Van Horn form the most notable examples. In some of these are promising veins, and in nearly all much work has been done, yet generally without such decisive results as to secure capital for the erection of mills or to warrant continued operations. In the Wilson district, situated in the Tollock mountains, 40 miles north of Aurora, were discovered in the summer of 1866 a number of auriferous lodes, several of which, having since been partially developed, are likely to prove valuable. Here, within the present year, a considerable town—Pine Grove—has been built up, a number of arrastras driven by steam and a 10-stamp steam quartz mill have been erected, and another mill of larger size partially completed. The lodes are of fair average size, some of them large, from 10 to 20 feet thick, and as a general thing show signs of permanency. So far as opened they display regular walls and linings, with other evidences of true fissure veins. The exploratory works consist of shafts and tunnels, some of the latter nearly 1,000 feet long and several of the shafts over 100 feet deep. From these excavations and from open cuts on the lodes a quantity of ore-bearing quartz has been extracted, a portion of which has been crushed with good results, the greater part being still retained awaiting better facilities for reduction. The gangue consists of an ochreous quartz, much of it easily pulverized from partial decomposition. The yield of the ores so far reduced has run from $30 to $90 per ton, worked by simple settling tub and blanket process.

The gold is generally diffused throughout the veinstone and is extremely pure, being 917 fine and worth within a fraction of $19 per ounce. There is sufficient water near the mines for the use of several large steam mills, Walker river, eight miles distant, to which there is a good road with a descending grade, also supplying a large propulsive power. The mountains throughout the district are covered with forests of piñon, rendering the supply of fuel at cheap rates certain for some years. These mines are accessible over good wagon roads from California, and in the vicinity of a productive agricultural district, with fine timber lands but 40 miles distant, conditions that must tend greatly to facilitate their development. In the Washington district, 20 miles south of Pine Grove, a number of argentiferous veins, carrying also copper, galena, and antimony, were discovered in the early part of the present year, some of which have since been prospected. A 10-stamp steam mill for the reduction of the ores has lately been put up in the district, where there are now about 150 men at work on the mines. The lodes are of good size, and carry ore which, from the limited tests made, it is thought will yield well by mill process. The situation of this district and the supply of wood and water are much the same as of the Wilson district. A good deal of ore is now out lying on the dumps awaiting means of reduction. Bunch grass is abundant throughout all this region, and as the climate is mild, but little snow falling in the winter except on the higher mountains, stock keep in good condition the year through without fodder. Ranging from 30 to 50 miles in a southeast direction from Aurora, and lying partly in California, are the Hot Spring, the Blind Spring, and the Montgomery districts, discovered in 1864, since which time a considerable amount of ore has been extracted from some of the lodes, though but few well-planned or persistent efforts appear to have been made looking to a systematic development of the mines. Some of this ore has been sent to San Francisco for sale or reduction; a small quantity has been beneficiated at the mines, while a large amount remains on the dump piles undisposed of. A difficulty with many of the lodes in these districts is the want of well-defined ore channels, the deposits occurring more in the shape of pockets or bonanzas than of regular strata, and hence deficient in continuity and persistence in depth. These bunches, however, are frequently large, and being easily broken out, can usually be mined with a remarkable prospect of profit. Most of the ore here is an argentiferous galena, the large percentage of base and refractory metals it contains, of which manganese, antimony, and copper are the principal, rendering smelting necessary, not more than 30 per cent. of the fire assay being saved by ordinary modes of reduction. Some, however, is rich in silver, yielding, where thoroughly treated, from $300 to $500 per ton, selected lots turning out a great deal more. Two small mills and a number of smelting furnaces have been put up, which, considering their limited capacity, have made a fair turn-out of bullion. These districts are moderately well supplied with wood, grass, and water, Montgomery, containing an abundance of piñon; and the opinion may be expressed that with the aid of capital and skilled labor a thrifty mining business may yet be established.

Columbus district, situate about 50 miles east of Aurora, and the same distance southeast of Walker lake, is another of the more noted mining centres of Esmeralda county, at least so far as the possession of numerous lodes is concerned. The developments have not been extensive. Adjacent to this are several other districts, the most of which have been too little explored to justify notice, though all contain metalliferous veins of either the precious or useful metals and often of both. But little work, however, has been performed in any of them, and they are mostly deficient in wood and water, which latter is also the case in the Columbus district. Here, however, a number of the veins have been partially prospected and working tests made of the ores, which have generally yielded good returns. The ledges are mostly in the hands of men of small means, while the remoteness of the district has prevented it from being visited by strangers and perhaps from attracting the attention it deserves. Certain it is the lodes are of fair dimensions, some of them very strong and marked by regular walls and well-stocked ore-channels. The top ore consists largely of chlorides mixed with sulphurets, often exhibiting a little free gold and native silver; the accompanying metals are copper and lead. Various crushings of small lots, some of which it is claimed were not closely worked, have given proceeds ranging from $50 to $200 per ton, a good result considering the quantity of ore of this class that can easily be obtained; so that the prospect is not unfavorable. The country here is rugged and generally barren, consisting of high hills and mountains, interspersed with sandy plains and salt beds. The mountains are scarred with volcanic outflows and masses of basalt, intermingled with trachytic rock and dikes of trap, indicating a period of great upheavals and disturbance of the earth's crust. Along the flanks of the volcanic breaks portions of the original metamorphic and stratified rocks are found traversed and seamed in many cases by the metallic bearing veins of gold, silver, copper, lead, and iron. The elevated portions of this district consist of a northeasterly extension of the White Mountain range, which a short distance to the southwest rises to a height of 10,000 feet, their tops and northern slopes being covered a good portion of the year with snow. A small town containing some 200 inhabitants has been settled near the principal mines, distant from which about eight miles are forests of piñon. There is but little wood in the immediate vicinity. A number of extensive salt deposits exist in the district, from which this article can be obtained quite pure and at small cost. One of these salt beds is estimated to cover an area of 30 square miles. Hay and other agricultural products can be procured from Fish Lake valley, a fertile farming district 20 miles southeast of the mines, at which place several hundred tons of hay were cut, and considerable quantities of grain and vegetables were raised the present year. While springs and streams are scarce, water can be found in many places by digging to a moderate depth, though it is often slightly brackish. A four-stamp steam mill has recently been put up in this district and is now operating with satisfactory results. Another and larger mill is about being erected, creating a probability that the business of mining, long dormant, will soon be prosecuted with energy. The Silver Peak district lies about 90 miles a little south of east from Aurora, the great salt bed of this region, covering over 40 square miles, bordering it on the east, and the Red Mountain district on the west. The lodes in these districts, taken in connection with the vast improvements contemplated and in progress, a portion of them completed, render this a promising and important mining locality. The metalliferous lodes are numerous, and, as shown by working tests, well charged with the precious metals. Those in the Silver Peak district are for the most part argentiferous, while the Red Mountain veins are chiefly gold-bearing. All the valuable lodes, so far as discovered in these two districts, are now owned by the Great Salt Basin Mining and Milling Company, who are proceeding to develop them with skill and energy. The first discovery and location of mineral lodes in this region was made at Red Mountain in 1863, which having been followed up the next year by the erection there of a small three-stamp mill, the value of the auriferous veins at that place was soon established. The same year, (1864,) the Silver Peak mines were discovered, and here a 10-stamp mill was built in the fall of 1865, which after running for a short time with moderate success suspended for repairs, but never after resumed operations, the owners having disposed of it in common with their mining properties to a company of eastern capitalists, the same who are now proceeding to work the mines on a liberal and extended scale. The present property of this company in these districts consists of about a hundred different lodes, some of them of good size and supposed value, a 10-stamp mill, intended to reduce ores without roasting, as practiced at Gold Hill and Virginia, or for testing them and ascertaining the best methods for their reduction, a three-stamp mill, operating on the auriferous ores at Red Mountain, and a 1.000 acre tract of piñon forests lying adjacent thereto and embracing the best lands of this kind in the country, together with numerous improvements in the shape of shops, corrals, stables, offices, storehouses, and buildings for workmen. On the margin of the Great Salt bed, adjacent to their principal mines, and a large spring of fresh water, a site has been secured for a mill and all attendant uses. On this spot a first-class mill is now being erected, most of the lumber, machinery, and other material being on the ground. This establishment, which it is intended shall be complete in all its appointments, will start with 20 stamps at first, to which others will probably be added, the intention being that 60 stamps shall be running there before next summer. Among the improvements projected by this company is a system of railways, embracing a main trunk running to the centre of their principal claims, to be extended to the most distant in Red mountain and having branches ramifying throughout both districts. This railway will terminate at their principal mill, and over it all their ores will be transported, dispensing with the necessity for team-hauling almost entirely, and thereby effecting a great economy in current expenses. As justly remarked by Mr. J. E. Clayton, a well-known engineer, after a careful examination, the property of this company constitutes a favorable combination of available resources and local facilities. With their plans carried out they will probably be able to mine and reduce their ores at a profit. In the quantity of average grade ores and easy transportation to their mills—the prime agents of cheap reduction, water, salt, and fuel close at hand, and a good agricultural district, Fish Lake valley, not far distant—are supplied some of the necessary requisites of a promising mining enterprise. Experience thus far had encourages the hope that these investments will prove remunerative.

SECTION XV.

LINCOLN COUNTY.

This county, named after the late President Lincoln, was erected from Nye county by act of the State legislature at its last session. Its boundaries are as follows: beginning at the Red Bluff springs, about 15 miles east of the Reville district, and running thence east to the State line, which it follows to the south boundary of the line separating it from Arizona, along which it runs west until it reaches a point due south of Red Bluff, and thence north to the latter place. It occupies the extreme southeastern corner of the State, and does not differ materially in its physical features and natural productions from the adjacent portions of Nye county, elsewhere described. The country is corrugated, like that farther north and west, by alternating ranges of mountains and valleys, the former lofty and covered with a sparse growth of bunch grass, with numerous small streams of water and patches of piñon and occasionally larger timber, while the latter contains a number of fertile spots on which hay can be cut from the native grasses and good crops of grain raised with the aid of irrigation. The county seat has for the present been fixed at Hico, the principal settlement. The county is now fully organized, having a full set of officials and constituting the ninth judicial district of the State. The first discovery of silver-bearing lodes in this region was made about three years ago, since which time a population of several hundred has been gathered there, though as yet no great amount of work has been done. Many of the mountain ranges are found to contain metalliferous veins of greater or less magnitude and value, but the most valuable so far as discovered, and the only ones yet at all developed, are situate in the Pahranagat district, in the eastern part of the county, in a high range known as Quartz mountain, its altitude being about 11,000 feet.* The geographical position of this district is nearly in 37° 37′ north latitude, and 112° west longitude. The principal mineral deposits are found in a belt about five miles long and two wide, stretching across the foot-hills and spurs of the mountain. This belt contains several distinct systems of lodes, all bearing the features of true fissure veins, having smooth and, in places, striated walls with clay linings. They are of medium size, many of them cropping boldly and traceable for a good distance. The country rock is principally a metamorphic limestone, the stratification greatly disturbed. The ores on the surface are associated with copper and argentiferous galena, and show by assay a percentage of silver varying from $50 to $2,500 per ton. The vein stone is quartz and calspar, carrying iron, zinc, and manganese, rendering reduction somewhat troublesome, and necessitating roasting as a general thing, or a resort to smelting where the sulphuret of lead prevails. After roasting the ores are tractable, rendering amalgamation easy and giving bullion from 800 to 900 fine, there being but little gold present. Some of the copper ore here assays as high as 50 per cent. of metal, making it probable that it will yet be of economic value when better facilities for its transportation elsewhere are extended to this region. The veins are for the most part well situated for extraction of their contents, with available ores accessible from the start. The mountains adjacent to these mines are tolerably well stocked with piñon and juniper, but water is not abundant, in consequence of which all reduction works will probably, for the present at least, be located in Pahranagat valley, 12 miles east of the mines, where the mountain benches afford good mill sites, with plenty of water issuing from several springs. Thirty miles east of Pahranagat are found groves of timber suitable for making a fair article of lumber. Many of the ranges further west also contain similar trees, a species of white pine, with some fir.

The climate of this region is milder than its geographical position and elevation—over 7,000 feet—would indicate, the atmosphere being tempered by the warm current of air from the Gulf of California, flowing up the valley of the Colorado. Pahranagat valley, which is 35 miles long north and south, and 10 wide, contains about 20,000 acres of natural meadow land, or of soil that can be rendered arable by irrigation. Most of this will grow crops of grain and vegetables, that cultivated there the present year having yielded largely. Until the population becomes numerous, enough of hay, grain, and vegteables can be grown to meet local demands; afterwards supplies can be drawn from the Mormon settlements not far distant to the southeast, and from which grain is now brought and sold in the valley, at six cents per pound; flour at 10 cents, and beef at 15 cents. Hico is but 135 miles from Callville, at the so-called head of navigation on the Colorado river; that is, as the wagon road now runs, which can probably be reduced to 100 miles, rendering it possibe that goods and machinery may yet reach this region through that channel. There is now one five-stamp mill completed, with two others of larger capacity underway, in this district. The first not having facilities for roasting the ores, failed in the earlier efforts. Furnaces having been built, with which also the new mills are to be supplied, no further trouble in saving the metal is apprehended, and there is now a fair prospect that the more extended operations about to be initicted will prove remunerative to the pioneers of this distant region.

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*See section on eastern Nevada, Pahranagat district.

SECTION XVI.

THE COMSTOCK LODE.

The mining interest in Storey county centres almost exclusively in the Comstock lode. Not that it is the only silver-bearing lode in the district, but the others which are worked yield so small a proportion of the bullion produced as almost to be overshadowed by their great neighbor. The Comstock lode may be called the "mother vein" of the district, but both to the east and the west of it lie veins which may become at no distant day valuable property. Of these the New Brunswick lode, on which are located the St. John, Occidental, and other mines, is worthy of most attention, not only from its steady yield of bullion, but on account of its peculiar veinstone. The usual gangue in the Comstock lode is quartz; in the New Brunswick it is almost entirely carbonate of lime, an analysis of the rock showing the following composition:

Gold	.0016	$5 02
Silver	0250	10 98
Peroxide of iron	1.6370	
Peroxide of manganese	.2500	
Alumina	.7750	
Carbonate of lime	83.7240	
Sulphur	.0050	
Chlorine	Traces.	
Silica	13.2500	
Loss	.3324	
	100.0000	16 00

This analysis shows less than the usual amount of the precious metal, the mine at present yielding about 30 tons of ore daily, of an average value of about $25.

In the southern part of Gold Hill are many small veins or deposits of decomposed quartz and lime, yielding gold worth about $10 an ounce; these veins are worked chiefly by private individuals on a small scale, and furnish employment for several arrastras in Gold cañon.

But, as before stated, the mining interest centres chiefly in the Comstock lode.

In the preliminary report a large amount of information was furnished relative to the general features of this district and its mining resources. To avoid repetition the remarks in the present report will be confined mainly to the condition of the lode at this time. In order to preserve continuity, however, it will be necessary to go over some of the ground already traversed. For concise description the subject is divided into separate headings.

CHARACTER OF THE COMSTOCK LODE.—The Comstock lode runs along the eastern slope of the Washoe mountains, at the foot of Mount Davidson, its loftiest summit. Its outcrop is not by any means continuous, consisting of parallel belts of quartz, extending from east to west, in some places nearly 1,000 feet, which show themselves chiefly on the tops of the spurs, running down from the main ridge. The western of these quartz seams, being of a hard crystalline texture, form the most prominent outcrops, but experience has shown them to be of less value than the eastern bodies, which from their different composition have been more easily disintegrated, and are often covered up by the debris from the higher and steeper portion of the mountain.

LENGTH OF LODE.—The vein has been more or less thoroughly explored, (see table of mines in preliminary report, pages 72 and 73,) and its continuity established by underground workings for a length of about three and a half miles, though the productive portion forms but a small proportion of the whole, as barren spots of great extent intervene between the bonanzas or ore bodies.

STRIKE OF LODE.—Its "strike" or course, as shown by the exposure of the west wall, in numerous places, is nearly magnetic north and south, (north 16° E. by true meridian.)

Enclosing Rocks.—But little if any doubt now remains that the Comstock is a true fissure vein. The enclosing rock on the east throughout its entire length as far as known is "propylite," a species of porphyry, varying much in its appearance at different points, as the crystallization is coarser or finer, and decomposition more or less advanced. The country rocks on the west vary considerably. On the slopes of Mount Davidson and Mount Butler it is sienite; north of this propylite occurs on both sides; while in southern Gold Hill various metamorphic rocks occur on the western side.

West Wall.—The west wall of the lode is separated from the country rock by a well defined clay selvage, and maintains a remarkaby uniform dip of about 38° or 40° to the eastward at the surface, gradually increasing to about 45°, which it maintains to the lowest depths hitherto explored. The east wall near the surface has a false dip to the westward, gradually becoming vertical, and at a depth of 400 or 500 feet turns to the eastward, and continues down more or less parallel with the west wall. Owing to the flat dip of the lode this eastern or hanging wall is less clearly marked than the western or foot wall, frequently dropping down on or near the foot wall. When this is the case, another clay is usually found to the eastward, and this structure will probably continue for an indefinite depth. Developments appear to show it to be most frequent where the walls of the lode approach each other rapidly.

Width of Lode.—The jaws of the fissure at the surface, as before stated, are from 500 to 1,000 feet apart, gradually approaching each other in depth until the fissure is reduced to an average width of 150 feet. This is not maintained, however, with any regularity. The west wall maintains a tolerably straight course, though conforming to some extent to the general direction of the mountain range; but the eastern clays are full of sinuosities, which produce in the vein a series of swells and nips. In Virginia these are very strongly marked, the nips usually occurring where the lode intersects a ravine, and the swells corresponding to the prominent spurs of the mountain. One of the best illustrations of this structure occurs in the ground owned by the Savage, Hale and Norcross, and Chollar-Potosi Mining Companies. At the north line of the Savage mine the clays, including what is generally termed the vein, are probably about 100 feet apart. Going southward they diverge to a width of 500 feet or upwards, again contracting to the southward, rapidly at first, and then more gradually, until, at a point in the Chollar-Potosi mine 1,900 feet south of the starting point, the vein matter included between the same clays is not more than 20 feet in thickness, and consists principally of an irregular clayey mass, caused by the union of several seams of clay, which show themselves in the vein to the northward. This great swell of the eastern clay unites the clay bounding two subordinate swells, spanning at the same time what was supposed to be a nip of the vein, and recent developments render it probable that clays will yet be found to the east of apparent contractions of the lode, uniting the swells which bound them to the north and south. The importance of thoroughly understanding this feature of the lode will become apparent when the difficulties of exploring the Comstock lode come under consideration.

Filling of the Vein.—It must not be supposed, however, that the whole of this immense fissure is filled with valuable ore. Near the surface the aggregate thickness of the quartz seams is in many places not more than five-sixths of the total width of the lode. There are points where developments show upwards of 150 feet of quartz, occurring between the clays without any intermixture of foreign matter, but when this is the case the mineral is distributed through the whole mass too sparingly to make it valuable at the present time. Considering the vein as a whole, it is safe to say that at least two-thirds of it are filled with immense "horses" or masses of country rock, chiefly detached from the hanging wall, between which are found the belts of metalliferous quartz. These masses of country rock are frequently of such great length and thickness as to have formed one of the strongest arguments in favor of the theory that there was not merely one lode, but a belt of lodes running along the foot of Mount Davidson. They are usually bounded by clay selvages, uniting and dividing, both in the length of the lode and vertically, producing a complicated network of clay seams throughout its entire length, which materially interferes with its drainage. Other portions of the lode are filled with a brecciated mass of porphyry quartz and clay, which, from the rounded character of the enclosed pebbles, gives evidence of the intense dynamic action of the vein.

BONANZAS, OR ORE BODIES.—The ore bodies lie chiefly in the swells of the vein, usually forming in their upper portion, at or near the eastern clays, and, as their position is more vertical than the dip of the lode, they gradually drop down on the west wall, leaving room to the eastward for the formation of new bodies. In Virginia their form is usually that of lenticular masses, with their longer axes in the direction of the lode, dipping at the same time to the southward. In Gold Hill the ore occurs in sheets, lying more or less parallel to the east wall, the change from one structure to the other occurring in the Chollar-Potosi mine. The bonanza in the Ophir-Mexican mines was about 200 feet in length and 330 in depth, attaining a maximum thickness of about 45 feet, and tapering above and below to two or three feet. The Gould and Curry bonanza was nearly 650 feet long, over 500 feet in depth, and about one hundred feet wide at its greatest expansion. The immense deposit of ore in the Savage and Hale & Norcross mines first showed at a depth of about 500 feet. It partakes of the crescent shape of the east clay, which it follows closely, varying in width from 10 to 50 feet. It is known to extend to a depth of over 250 feet, and will probably continue as much lower. Its total length is upwards of 800 feet. In the Chollar mine a large lenticular mass of red ore, 200 feet long, 300 deep, and about 25 wide, has been developed. In the Potosi the ore lies in a sheet near the eastern clay.

ORES.—The ores of the Comstock consist chiefly of vitreous silver ore, stephanite, native silver, and argentiferous galena, imbedded in a quartz gangue. Beside these, ruby silver, horn silver, and polybasite occur in small quantities; also, native gold, iron and copper pyrites and zinc blend. These all usually occur in an amorphous condition, good crystallized specimens being remarkably rare. In the Kentuck mine (Gold Hill) carbonate of lime occurs in the gangue, and in the deep workings in Virginia sulphate of lime is an abundant mineral. The Fairview mine formerly produced fine crystals of the latter.

DEVELOPMENTS ON THE COMSTOCK LODE.—The structure of the lode, as shown by the underground works, has already been spoken of. The true dip of the lode was not understood for some time after its discovery. The false dip of the east wall at the surface induced a belief that the vein would pitch to the westward, and, consequently, the first working shafts were located accordingly. The majority of these, at least in Virginia, reached the west wall at depths varying from 450 to 600 feet, and owing to the intensely hard nature of the western country rock had to be abandoned as far as deeper explorations were concerned; the cost of sinking and drifting back into the vein, the constant repair required by shafts located *in the vein*, and the necessity of more powerful machinery as great depth was attained, all tending to this result. The principal companies mining on the Comstock, in Virginia and North Gold Hill, have accordingly erected new hoisting works, about 1,000 feet east of the old shafts, on ground not likely to settle to any serious extent, and in these shafts the following depths have been attained:

Gould & Curry	850
Savage	670
Hale & Norcross	500
Chollar Potosi	830
Empire-Imperial (Gold Hill)	920

These shafts are, or will be, furnished with machinery of the finest description, capable of working to depths ranging from 1,200 to 2,000 feet. In Southern Gold Hill the original shaft of the Belcher Company has been carried down to a depth of 850 feet.

While many of the originally discovered bonanzas have been worked out, depreciating the value of the mines where they occurred, as in the case of the Ophir and Gould & Curry, the comparatively recent discovery of the Savage-Norcross bonanza gives good foundation for believing that they will again become productive. This deposit was not found until the Hale & Norcross Company had been at work for nearly five years, and had attained a depth of 700 feet. Their location covered what was supposed to be a nip of the vein, and having exhausted all other means, as a last resource, the supposed east wall was pierced and a drift run to the eastward from the 700 feet level, with but little encouragement until, at 360 feet east of what had hitherto been considered the east wall, this magnificent discovery was made. The body of ore has been followed up 200 feet, and lying so far from the west wall, will, judging by analogy, continue down for a great depth. This discovery made valuable 800 feet of ground, which up to that time had produced nothing, though lying between the valuable deposits in the Gould & Curry and Chollar-Potosi mines.

Nearly 1,500 feet of ground between the Gould & Curry works and the Ophir mine is to-day in the former condition of this ground, having been prospected only to a depth of about 350 feet, and found to contain nothing, or merely ores of too small a value to pay for extraction. Much other ground which has been examined, chiefly in the neighborhood of the west wall, should be prospected to the east, experience clearly showing that all valuable ore bodies originate on that side of the fissure. The bodies of quartz forming on the west wall are uniformly barren, or of very inferior quality.

The development of the vein has been greatly retarded by various causes. Among these the most prominent have been the fear of causing litigation by prospecting to the eastward and making discoveries which were certain to be claimed by some of the innumerable locations made in early times, and the fact that almost all mining stocks are here owned only temporarily for speculative purposes. In the first respect a happier era is dawning. Repeated litigation has only tended to show conclusively that the many parallel outcrops of quartz, each of which was located by a different company, unite in depth or disappear entirely, and the titles to the principal mines are now nearly free from further dispute. As far as the latter cause is concerned, the trouble will probably continue for many years. To thoroughly understand any arbitrary section of ground a knowledge of the adjoining property is almost indispensable. This is frequently attainable only to a limited extent. It too often happens that the true condition and structure of a mine is concealed, lest the information should affect the schemes of those who are operating in its stocks. A combination of mining superintendents and the establishment of a general office, where maps of the various mines could be consulted by those desiring information, would prove prejudicial to mining-stock speculators, but would tend greatly to check the useless expenditure of money, and materially increase the legitimate profits of our mining enterprises, by enabling superintendents to lay out their work with judgment and greater certainty than is at present the case.

Mode of mining on the Comstock.—Shafts.—Mining on the Comstock is carried on almost exclusively through perpendicular shafts, explorations having penetrated below the deepest adits, which are now used almost exclusively as drains, to avoid the necessity of hoisting the water to the surface. The original shafts were much less substantial than those now in use, being merely lined with planks about three inches thick, the compartments being two or three in number and about four and a half feet square. The principal shafts now in use are fine specimens of mining engineering. The Curtis shaft of the Savage Company has four compartments, three of them, for hoisting, being five feet square, and the fourth, which is occupied by the hoisting machinery, five feet by six. The Bonner shaft of the Gould & Curry Company and the Chollar-Potosi and Empire-Imperial shafts are similar in their character, while the Hale & Norcross shaft, being intended for the exploration of much less ground, has only three compartments. The mode of construction in all these shafts is similar, cribs of 12-inch timbers being inserted every five feet, supported by vertical posts of the same size. This cribbing is covered on the outside by lagging of three or four-inch planks. Wooden guides are then inserted down each side of the compartments for the purpose of retaining the platform cages, used for ascent from and descent into the mine, in their places. For some years iron guides were much in use, but have now been superseded almost entirely by wood, as less liable to accident. The cost of sinking these shafts varies, of course, with the nature of the ground encountered. The Bonner shaft was put down to the depth of 525½ feet, at an average cost of $100 78 per foot, including such a proportion of the total cost of pumping and hoisting as was chargeable to this account. The following table shows the amount expended for each department of the work. It is made up for a depth of 692½ feet, and shows that the last 67 feet of the shaft cost considerably more in proportion than the upper portions, as it raised the average cost per foot to $109 36.

Cost of sinking the Bonner shaft.

Paid for excavation	$22,324 50
Lumber	5,400 05
Timber	9,670 67
Framing timbers	3,518 00
Placing timbers	1,570 50
Carmen	3,530 00
Lowering pumps, &c., &c.	4,683 75
Picks and drills	2,041 50
Powder and fuze	291 00
Candles	1,054 30
Other materials	1,777 13
Cost of running machinery, keeping pumps in order, pitmen, &c	19,817 00
	75,738 40

TUNNELS AND DRIFTS.—From these shafts drifts are run to the vein, generally about 100 feet apart vertically: but it seldom happens that the levels in any one mine correspond with those in the mines adjoining. This arises from the mines being worked entirely independent of each other. But few of these tunnels will stand without protection. The main working drifts are usually timbered every five feet, the timbers varying from eight to twelve inches square, according to the nature of the ground to be sustained. In many places, even 12-inch timbers cannot resist the immense pressure brought upon them by the slacking and expansion of the material through which the drifts are run, immediately on its exposure to the atmosphere. It is not uncommon to see timbers completely crushed, notwithstanding the utmost precautions, in six months after they have been placed in the mine. Main working drifts, after timbering, are usually about six feet high in the clear, three and a half to four feet wide at the top, and somewhat more in the bottom. Temporary prospecting drifts are much smaller in size, and generally left untimbered, if practicable, till they develop something of value. In each drift is laid a wooden track shod with iron, on which the material extracted from the mine is run out to the shaft in dumping cars, holding from 1,000 to 1,500 pounds. To avoid repeated handling of the ore or waste, the same cars are hoisted on the cage to the surface, and their contents there distributed to the proper places. The following tables will give some idea of the cost of this branch of mining:

Cost of tunnelling in the Gould & Curry mine, labor, materials, &c.

400 FEET LEVEL.

No. of feet.	Price paid per foot.	Total cost of excavation.	Timber.	Lumber.	Spiling.	Framing and placing timber.	Track iron and screws.	Picks and drills.	Powder and fuze.	Candles.	Air boxes.	Totals.	Cost per lineal foot.
39	$13 00	$767 00	$146 83	$9 12	$50 40	$42 00	$13 77	$22 50	$18 60	$27 00	$12 72	$1, 109 94	....
46	13 00	598 00	98 72	6 84	37 80	31 50	10 39	19 00	15 05	21 60	9 54	848 44	....
47	13 00	611 00	118 25	7 14	39 48	32 90	11 60	28 80	13 80	24 30	9 80	897 07	....
90	13 00	1, 170 00	220 24	13 68	75 50	63 00	20 28	40 75	21 90	28 35	19 80	1, 073 50	....
157	10 64	1, 661 00	308 04	18 84	122 46	110 50	41 68	67 00	31 20	89 70	62 80	2, 513 22	....
204	10 54	2, 151 00	402 21	24 60	110 70	143 50	55 70	86 00	44 40	118 39	82 00	3, 218 50	....
163	10 67	1, 739 00	297 55	18 20	92 53	113 75	48 84	98 00	30 00	91 03	65 00	2, 593 90	....
132	11 47	1, 515 00	241 72	14 78	70 20	92 50	35 45	59 00	43 87	72 93	52 80	2, 198 25	....
40	13 00	525 00	74 55	4 80	24 00	28 00	10 68	19 00	21 37	22 44	16 00	745 84	....
938	....	10, 737 00	1, 908 11	118 00	623 07	657 65	248 39	440 05	240 19	495 74	330 46	15, 796 66	$16 84

200 FEET LEVEL.

No. of feet.	Price paid per foot.	Total cost of excavation.	Timber.	Lumber.	Spiling.	Framing and placing timber.	Track iron and screws.	Picks and drills.	Powder and fuze.	Candles.	Air boxes.	Totals.	Cost per lineal foot.
30	$8 00	$240 00	$73 41	$4 56	$25 20	$21 00	$7 25	$10 00	$10 65	$13 50	$6 36	$411 93	....
60	10 00	600 00	146 83	9 12	67 20	42 00	14 02	15 00	16 00	24 30	12 72	947 19	....
81	11 00	891 00	198 51	12 31	68 04	56 00	18 61	19 50	21 30	24 30	16 96	1, 326 53	....
101	11 00	1, 111 50	244 72	15 20	84 00	66 00	23 20	35 75	24 00	24 30	22 00	1, 650 67	....
66	10 00	660 00	159 66	9 88	54 60	45 50	14 98	34 00	18 60	26 32	14 30	1, 037 24	....
171	12 05	2, 061 00	241 50	98 16	76 20	87 50	30 86	38 00	36 00	75 60	28 60	2, 772 92	....
120	12 75	1, 532 00	306 42	151 29	53 30	210 00	18 82	41 00	18 00	68 64	35 00	2, 437 47	....
101	11 79	1, 191 00	222 00	63 00	43 20	56 00	20 95	41 50	17 10	46 20	32 00	1, 732 95	....
209	11 64	2, 433 00	468 83	15 68	79 80	98 00	45 46	102 00	39 60	78 54	56 00	3, 416 91	....
215	11 64	2, 504 00	420 19	55 44	104 22	77 25	50 57	75 00	36 37	106 58	13 10	3, 442 73	....
264	7 32	1, 934 00	512 31	70 50	142 50	175 00	73 50	111 00	60 00	140 25	100 00	3, 319 06	....
47	16 49	775 00	126 82	44 35	9 00	32 90	5 21	37 00	7 50	28 26	....	1, 064 04	....
1465	....	15, 932 50	3, 120 60	549 49	807 26	967 15	322 93	562 75	305 12	654 80	337 04	23, 550 64	$16 08

STOPING is universally conducted by opening a level below the body of ore to be extracted, and working upward on the vein. On the Comstock, the openings made in mining the ore are so large that a complicated system of timbering is requisite to replace the material extracted. A rectangular system of timbers is usually adopted, the posts being about seven feet in length, 12 inches square, and placed about five feet apart from centre to centre. These are retained in their places by "caps" and "sills," and further to secure the mine each floor, as far as practicable, is filled up with waste material as soon as it is worked out. In early days too little attention was paid to this last precaution, resulting in extensive "caves" or giving way of the ground from the superincumbent pressure. If a body of ore is entirely extracted the result is not serious; but should any remain untouched, the cost and difficulty of securing it after a "cave" has occurred in its vicinity is usually greatly increased from the broken and shattered condition of the ground. The quantity of timber used in these stopes is immense, as will be seen by the details of the annual consumption on a future page. Any means which would diminish its price would be a great gain to the entire community.

PROSPECTING for new ore bodies forms a serious item in the cost of mining on the Comstock. When the great and irregular width of the vein, the irregular distribution of the ore bodies, the uncertainty of their occurrence, and our imperfect knowledge of the structure of the vein are taken into consideration, the difficulty of laying out prospecting works to the best advantage becomes apparent. Immense sums of money are spent annually in this kind of work, which must be taken entirely from the pockets of the shareholders when a mine is unproductive. If only moderately productive the entire revenue may be consumed in looking for more valuable bodies of ore; at the same time, the certainty of being richly rewarded for years of waiting if they are found, induces the continuation of work on mines which have not yielded a dollar for years. They are known on the main fissure of the Comstock to be surrounded by good property, and may become valuable at any moment. The Hale and Norcross mine is a good illustration. The following extract is taken from the annual report of the president of the company, for 1866:

> Heretofore the entire expense of opening the mine, erecting machinery, &c., had to be borne from money collected by assessments, until they aggregated the sum of $350,000, equal to $875 per foot. For the year just ended the trustees have been enabled to return to the stockholders, in dividends, the sum of $490,000, equal to $1,225 per foot, or, in one year to repay the assessments collected in five years, with the handsome sum of $350 per foot in addition, besides carrying over the large surplus in cash of $133,288 99, equal to a further sum of $333 22 per foot, making altogether the handsome profit, in one year, of $1,558 22 per foot, or 155 per cent. on the par value of the stock.

In this connection the advantages of a community of knowledge and interest among the mining superintendents would be of immense value, the experience of all becoming available by each, thus reducing the cost of explorations by showing in what portion of the different mines deposits of ore are most likely to be found, and thus directing attention more particularly to them. Every dollar spent on an unproductive mine is so much taken out of the aggregate net profits of the mining interest, and every dollar which can be saved would be equal to the same amount distributed in dividends. But because a mine on the Comstock is unproductive to-day, is no reason why it should be abandoned. The only point to be considered is how it may be developed in the most economical manner, and the plan suggested above appears to afford a solution of the difficulty. The inefficient character of the results obtained by many companies working on the Comstock lode, when compared with the money expended, is well known to persons familiar with our mines, and can only be remedied by some such organization.

Number of engines on the lode.

Name of mine.	Hoisting.		Pumping.		Hoisting and pumping.	
	Number.	Estimated horse-power.	Number.	Estimated horse-power.	Number.	Estimated horse-power.
Allen	......	......	......	......	1	30
Sierra Nevada	1	60	1	200	......	......
Ophir Mexican	2	30	1	200	......	......
Sides	......	......	......	......	1	50
Gould & Curry	2	60	1	150	......	......
Savage, old shaft	1	60	......	......	......	......
Savage, new shaft	3	60	1	250	......	......
Hale & Norcross, old shaft	1	60	1	150	......	......
Hale & Norcross, new shaft	*1	......	......	......	......	......
Potosi	1	40	......	......	......	......
Chollar Potosi	1 1	60 20	1	60	......	......
Bullion	1	60	1	60	......	......
Exchequer	......	......	......	......	1	60
Alpha	......	......	......	......	1	60
Imperial	......	......	......	......	1	30
Empire	......	......	......	......	2	30
Eclipse	1	......	......	......	......	......
Plato & Bowers	......	......	......	......	1	10
Consolidated	......	......	......	......	2	20
Challenge	......	......	......	......	1	35
Confidence	......	......	......	......	1	25
Yellow Jacket, old shaft	1	60?	......	......	......	......
Yellow Jacket, new shaft	2	60	1	100?	......	......
Kentuck	......	......	......	......	1	60
Crown Point	1	40	1	40	......	......
Belcher	1	60	1	40	......	......
Seg. Belcher	......	......	......	......	2	30
Overman	1	40	1	60	......	......
North American	......	......	......	......	1	......
Total	22	......	11	......	16	......

* Donkey engine.

These engines were almost universally, in early times, attached to friction hoisting gear, but the increase of depth attained has almost banished this mode of operation, the great weight of the rope and car rendering it unsafe. Flat wire ropes have almost entirely superseded the hemp ropes originally employed. For hoisting ore cages are employed in all instances, buckets being used only for sinking in the shafts. These cages are fitted with a variety of appliances to insure safety in case of accident to the ropes or hoisting machinery.

PUMPS.—The largest pumps in use are 14 inches in diameter; the greater number, however, range from 10 to 12 inches. The amount of water to contend with varies greatly in different mines, being, as a whole, more abundant in the north end of the lode. The Ophir Mexican pump throws about 300 gallons per minute, and must be run steadily to keep the mine free of water. The Bullion mine, about one mile to the southward, is comparatively dry, and in most cases a few hours' pumping daily is sufficient to rid it of water. Small pumping machinery would generally be sufficient was there not always a risk of tapping bodies of water dammed up by the clay seams in the vein already spoken of. These reservoirs generally yield a large volume when first struck, but rapidly diminish to a small stream. The machinery must be adequate, however, to the duty imposed upon it at such times, otherwise serious detention and damage may be the result.

AMOUNT OF ORE RAISED FROM THE MINES.—The amount of ore raised from the mines on the Comstock lode may be put down at the present time at about 1,500 tons daily, and the total amount raised since the commencement of operations at about 2,000,000 tons. The following table, compiled by S. H. Marlette, the surveyor general of Nevada, from returns made to the assessor, for the year 1866, shows the number of tons produced quarterly by the several mines which yielded more than $20 per ton. Some mines, owning mills of their own, work rock yielding as low as $15 per ton, but no record of this becomes public, and is very difficult to obtain, chiefly owing to disinclination on the part of owners of unincorporated mines to make their operations public. The table also shows the yield of the ore per ton.

YIELD OF ORE PER TON.—From information furnished by the superintendents of the following mines, the yield per ton appears to be—

Savage mine—30,250 tons produced in the last six months of 1866, yielded an average of $42 93 per ton.

Hale and Norcross mine—16,836 tons produced in the same time, yielded an average of $50 33 per ton.

Gould and Curry mine—62,425 tons produced in 1866, yielded an average of $28 64 per ton.

The following table shows the number of tons of ore, worth more than $20 per ton, produced quarterly by mines on the Comstock lode, names of the mines, and yield of some of the ores:

Companies.	ORE PRODUCT OF MINE.*									ORE SOLD.								
	First quarter.		Second quarter.		Third quarter.		Fourth quarter.		Total.	First quarter.		Second quarter.		Third quarter.		Fourth quarter.		Total.
	Tons.	Per ton.	Tons.	Per ton.	Tons.	Per ton.	Tons.	Per ton.	Tons.	Tons.	Price pr. ton.	Tons.	Price pr. ton.	Tons.	Price pr. ton.	Tons.	Price pr. ton.	Tons.
Utah																		
Allen																		
Sierra Nevada																		
Union																		
Ophir	1,596	$44 91	4,562¼	$28 28	1,878	$27 10	430	$26 94	8,466¼									
Mexican			100	30 00	676	37 79			776			35	$2 85					
Central																		
California																		
Central No. 2																		
Kinney																		
White & Murphy																		
Sides																		
Best & Belcher																		
Gould & Curry	13,547	32 64	11,897	37 60	15,100	25 00	13,883	23 00	54,427									
Savage	7,224	50 23	6,042	45 84	9,197	46 61	16.038	40 67	38,521	289	$3 00							
Hale & Norcross	2,658	26 17½	5,796	38 34	7,974	49 16	8,457.1	53 12	24,885.1									
Chollar-Potosi	8,144	24 66	10,553¾	23 87	7,811½	24 09	9,164¼	22 51	35,653¾	1,189¼	4 79	791½	4 33					1,980¾
Bullion																		
Exchequer																		
Alpha																		
Apple & Bates																		
Imperial	6,597	23 54	4,173	31 55	7,216	23 15	8,353	29 39	26,339									
Bacon	1,370	25 26																
Empire	4,023	23 00			4,768	21 33¼	4,228	21 50	13,019									
Eclipse	1,617¼	24 67	960	21 17	2,830	20 85	4,180	20 87	9,587½	1,309¼	9 69¼	1,229½	10 00					2,538¾
Trench	1,624¼	25 25																
Plato	767	24 50			1,653	20 06			2,420									
Bowers'	1,415	20 18							1,415									
Piute	920¼	21 82	3,056	20 94					3,976¼									
J. D. Winters & Co.					3,598	26 55			3,598	1,205	5 63	362.9		532	$4 15½			2,099.91
Consolidated 21 feet	1,797	21 86¼	2,660	23 88	3,100	22 12½	2,848	21 87½	10,405	976	6 59¾							976
Gold Hill Q.M.& M.Co.	712	28 25	1,849	21 55	1,079	31 16	734	29 84	4,374	937	4 64							937
Challenge			854¾	27 26					854¾									
Confidence	1,362	22 27	2,126	26 22.8					3,488	496	5 00	784	7 33					1,280
Burke, Hamilton & Co.																		
Yellow Jacket	10,045	29 41	17,681½	28 70	26,859	35 28	23.985¼	27 07	78,570¾									
Kentuck	1,043	42 49¾	2.526.2	31 50	6.350¾	37 55¾	7,656	26 89	17,575.82									
Crown Point	8,133	44 06	8,368½	40 23	6,956	33 64¼	10,737	36 15	34,194½					329	2 50	1,142	$2 50	1,471
Belcher																		
Segregated Belcher	1,262½	24 00																
Overman (?)																		
North American (?)																		
Baltimore American (?)																		

COST OF MINING PER TON.—The following items are from official sources:

Savage mine—average cost per ton of the last six months of 1866.

Officials	$0 39
Extracting ore	3 00
Prospecting	65
Accessory work	1 64
Improvements	2 04
Incidental expenses	1 10
Total cost per ton	8 82

Gould and Curry mine—average cost per ton for the 12 *months ending November* 30, 1866.

Officials	$0 21
Prospecting and dead work	2 11
Extracting	3 10
Accessory	1 82
Improvements	62
Total cost per ton	7 86

Hale and Norcross mine—average cost per ton for the 12 *months ending March* 20, 1867.

Managerial	$0 31.7
Hoisting	2 38.7
Mining	4 79
Improvements	65.9
Incidentals	92.9
Total cost per ton	9 08.2

These results show a marked improvement on previous years, and enable lower grade ores to be worked more profitably than was formerly the case. Some portion of the diminution in cost is due to the lower price of material, but by far the greater part to more efficient management and systematization of labor.

Tabular list of mills crushing ore from mines

Names.	Owners.	Location.	When built.	Estimated cost.	Assessed value.
STOREY COUNTY.					
Atlas	Haggin & Tevis	Lower Gold Hill	1861	$35,000	$21,000
Atwood's	George Atwood	Flowery (Six Mile Creek)		35,000	19,550
Bay State	Bay State Mill Co	American Flat		40,000	24,000
Bowers'	L. S. Bowers	Crown Point Ravine, (G.H.)		100,000	15,400
Central	J. B. Dickenson	Virginia		75,000	23,000
Crown Point (1)	Crown Point G. & S. M. Co.	Crown Point Ravine, (G.H.)	1862	40,000	20,000
Comet (1)	New York & Nevada M. Co.	Gold Hill		40,000	
Douglas (1)	C. S. Wheeler	Lower Gold Hill	1862	40,000	12,000
Eclipse	Eclipse M. & M. Co	Gold Hill		50,000	35,000
Empire State	Wm. Sharon, Agent	Seven Mile Cañon		35,000	8,800
Empire No. 1 (1)	W. S. Hobart	Virginia	1860	75,000	12,000
Empire No. 2 (1)	Empire M. & M. Co	Lower Gold Hill	1860	80,000	26,500
Gold Hill	Gold Hill Q. M. & M. Co.	Gold Hill	1860	30,000	25,000
Gould & Curry	Gould & Curry M. Co	Seven Mile Cañon		380,000	305,000
Hoosier State	Clark & Hearst	Virginia	1862	40,000	14,730
Imperial	Imperial S. M. Co	Lower Gold Hill	1860	75,000	40,000
Land's	Charles Land	Seven Mile Cañon		60,000	15,000
Mariposa	J. V. McCurdy	do		20,000	10,100
Marysville (1)	O'Neale, Rule & Glasier	Lower Gold Hill		50,000	12,000
Ogden	O. S. Carvill	Virginia		50,000	24,000
Pacific	Sharon & Co	Lower Gold Hill	1863	75,000	45,600
Petaluma (1)	Greely Bros	do		30,000	12,500
Piute	M. Livingston	do	1863	80,000	47,000
Rhode Island	Crown Point G. & S. M. Co.	Gold Hill	1862	100,000	48,000
Rigby's (1)	Rigby & Co	American Flat		25,000	10,100
Rogers's (1)	Rogers S. M. Co	Seven Mile Cañon	1862	25,000	10,400
Sapphire	W. S. Hobart	Lower Gold Hill	1861	60,000	23,000
Simcooe	A. Bassett & Co.	Seven Mile Cañon		35,000	15,000
Stevenson's (1)	C. C. Stevenson	Gold Hill	1860	15,000	5,000
Succor (1)	O'Neale, Rule & Co	Lower Gold Hill		50,000	22,500
Summit	Mason, Carville & Wright	Virginia	(1)	50,000	20,525
Union	Wm. Kidd	Gold Hill	1861	25,000	10,000
Winfield	L. A. Booth	Seven Mile Cañon		80,000	19,000
Total........33				2,000,000	953,705
LYON COUNTY.					
Bacon	Lowe & Fair	Silver City	1863	$85,000	
Birdsall & Carpenter	Birdsall & Carpenter	Dayton	1865	(1)110,000	
Cole & Co	Cole & Co	Johntown	1864	10,000	
Confidence	Confidence M. Co	Silver City	1861	35,000	
Dayton No. 1	Winters, Kustell & Co	Dayton	1861	50,000	
Dayton No. 2 (1)	do......do	do	1864	40,000	
Daney	Daney M. & M. Co	3 miles from Dayton	1863	70,000	
Eagle		Silver City	1864		
Eastern Slope	Stevenson, Winters & Co.	Below Silver City	1862	60,000	
Eureka	Wheeler, Hurd & Dunker	Carson River, near Dayton	1861	100,000	
Excelsior	John Briggs	Johntown	1861	25,000	
Franklin	Wm. Sharon, agent	Carson River, near Dayton	1861	50,000	
Gold Cañon Reduction Works.	Wm. Sharon, agent	Silver City	1861	40,000	
Golden Eagle	O'Neale, Rule & Co	Carson River, near Dayton	1861		
Illinois	Wm. Sharon, agent	do......do	1864	30,000	
Imperial (Rock Pt)	Imperial M. Co	do......do	1861	250,000	
Island	O'Neale, Rule & Co	do......do	1862	40,000	
Monitor	Hirschman & Co	Gold Cañon, near Dayton	1865	6,000	
Ophir (New)	Ophir S. M. Co	Carson River	1864	75,000	
Phœnix No. 1 (1)	Hentsch and Berton	Below Silver City	1861	40,000	
Pioneer (1)	Sheldon & Hickok	Silver City	1861	40,000	
Sacramento (1)	Hunt, Woodruff & Co	Johntown	1861	50,000	
San Francisco	Charles Schad	Carson River, near Dayton	1861	40,000	
Swansea	W. Sharon, agent	Johntown	1862	60,000	

on the Comstock lode during the year 1866.

Motive power.	Horse power.	STAMPS.				WHEELS.		WATER.		WOOD.	
		Number.	Weight, pounds.	Drop in inches.	Drops per minute.	Kind.	Diameter, feet.	Fall, feet.	Amount, inches.	Cords per day.	Cost per cord.
Steam	36	15	600							4½	$13
do		16								4½	
do		23								6	
do		20	{ 10-600 { 10-700	9	70					4	14
do		13								8	
do	35	8	500	9	70					5	14
do		16								4½	14
do		10	650	8	78					4	12½
do		15								4	14
do		15								5	
do	60	16	650	9	80					5½	15
do	60	16	650	9	80					8	14
do	45	14	{ 6-750 { 8-600	7½	84					3	14
do		80								20	
do	20	8	750	9	70					3½	14
do	60	44	600	8						6	14
do		20								5½	
do		(1) 12								4	
do		9								5	
do		22								6	
do	80	30	650	10	72					8	14
do	30	10	700							3½	14
do	60	20	650	10	80					5½	14
do	(1) 150	25	650	10	80					8	14
do		10								4	
do		8								3½	
do	45	16	750	9	80					5	13½
do		16								5	
do		(2) 8	500	6	76					2½	14
do		20								6	
do		20	625		70					6	14
do	40	14	{ 10-650 { 4-500	10	60					2½	14
do		18								5	
		607								180½	
Steam	60	20	720	10	75					8	$11
Water		30	613	9	85	Overshot	50			1	10
Steam	20	5	480	9	65					2	10
do	35	(1) 12	900							5	
Water		20	600	10	75	2—central discharge	5½	12	1,500	1	8½
Steam	60	15	800	10	75					5	8½
do	45	15	550							6	
Water		5	400			Overshot	37		100	½	
Steam	60	12	1,100	10	50					6	11
Water		20	650			Turbine			2,500	3	
Steam	40	10	650							2½	
Water		10	600			Central discharge			2,500	2	
Steam	30	15	700	9	75					6	12
do	40	10	850							3½	
do	30	20	400							5	10
Steam and water	50	56	{ 16-600 { 40-550	8½	80	2—Overshot	{ 1—14 { 1—13½	14½	3,600	6½	10
do	25	10	720			Central discharge	2 4-5		1,800	4	
Water		5	450				32	32	1,200	½	
do	40	24	650			Turbine	10	14		1½	10
Steam	45	16	650							6	
do	45	15	700							6	
do	40	12	750							5	
Steam and water	30	10	650			Central discharge	10		1,100	3	
Steam	40	12	900							5	

Tabular list of mills crushing ore from mines on the

Names.	Owners.	Location.	When built.	Estimated cost.	Assessed value.
LYON COUNTY.-Con.					
Trench	Joseph Trench	Silver City	1861	$75,000	
Weston's (1)	Wm. Weston	Johntown	1862	35 000	
Weston's (1)	Wm. Weston	do	1862	8,000	
Total 27				1,424,000 25 mills.	
ORMSBY COUNTY.					
Brunswick	Williams & Sharon	1 mile below Empire	1863	$50,000	
Carson	W. Sharon, agent	3 miles west of Carson	1862	25,000	
Merrimac (1)	Rice & Yerrington	1¼ mile below Empire	1862	100,000	
Mexican (1)	Alsop & Co	Empire	1862	300,000	
Santiago	Santiago M. Co	4 miles below Empire, on Carson river.	1862	100,000	
Sierra	Beach & Harrington	3 miles west of Carson		25,000	
Vivian	P. Frothingham	3¼ miles below Empire	1860	75,000	
Yellow Jacket	Yellow Jacket M. Co	Empire	1864	150,000	
Total 8				825,000	
WASHOE COUNTY.					
Atchison	Savage Co	Washoe	1862	$75,000	
Buckeye	Lambert & Co	do	1863	60,000	
Manhattan (1)	New York & Nevada Co	do	1863	100,000	
Minnesota	Savage M. Co	do		75,000	
Napa	James Hill & Co	Galena		34,000	
New York & Washoe	New York & Washoe Co	Washoe	1863	100,000	
Ophir Reduction Works (1.)	Ophir M. Co	Franktown	1862	150,000	
Temelec	Baldwin & Bonner	Washoe	1865	60,000	
* Washoe Valley Reduction Works.	J. H. Dall	Franktown	1863	140,000	
Total 9				794,000	

Comstock lode during the year 1866—Continued.

Motive power.	Horse power.	STAMPS.				WHEELS.		WATER.		WOOD.	
		Number.	Weight, pounds.	Drop in inches.	Drops per minute.	Kind.	Diameter, feet.	Fall, feet.	Amount, inches.	Cords per day.	Cost per cord.
Steam	30	20	600							6	
do	40	15	550	9	80					4½	11
Water		10	250	9	70	Overshot	40	42	80	½	11
		424									
		29									
		395									
Water		8	1,000	10	80	Central discharge		21		1	7½
do		10								1	6
do		20								2	7½
Steam and water		44								4	7½
Water		24				2—Central discharge				1	7½
do		8								1	6
Steam and water		16	650	10	80	Central discharge	7	14		½	9
Water		40								1	7½
		170									
Steam		20								6	
do		10								6	
Steam and water		24								6	
Steam		16								6	
Steam and water		20								4	
Steam		24								8	
do		72								20	
Steam and water		15								6	
do	300	60				Breast	60			20	
		261								82	

Tabular list of mills crushing ore from mines on the

Names.	Owners.	Location.	When built.	Tons capacity.	Miles from mine.	Men employed.
STOREY COUNTY.						
Atlas	Haggin & Tevis	Lower Gold Hill	1861	25	1½	11
Atwood's	George Atwood	Flowery (Six Mile Creek)	......	20	4	......
Bay State	Bay State Mill Co	American Flat	......	35	2	......
Bowers'	L. S. Bowers	Crown Point Ravine, (G. H)	......	25	¼	12
Central	J. B. Dickenson	Virginia	......	12	½	......
Crown Point (1)	Crown Point G. & S. M. Co	Crown Point Ravine, (G. H)	1862	8	0	6
Comet (1)	New York & Nevada M. Co	Gold Hill	......	20	0	13
Douglas (1)	C. S. Wheeler	Lower Gold Hill	1862	16	1½	13
Eclipse	Eclipse M. & M. Co	Gold Hill	......	25	0	15
Empire State	Wm. Sharon, agent	Seven Mile Cañon	......	15	3	......
Empire No. 1 (1)	W. S. Hobart	Virginia	1860	30	1½	16
Empire No. 2 (1)	Empire M. & M. Co	Lower Gold Hill	1860	33	½	15
Gold Hill	Gold Hill Q. M. & M. Co	Gold Hill	1860	17	¼	14
Gould & Curry	Gould & Curry M. Co	Seven Mile Cañon	......	100	2	......
Hoosier State	Clark & Hearst	Virginia	1862	13	½	12
Imperial	Imperial S. M. Co	Lower Gold Hill	1860	30	¾	30
Land's	Charles Land	Seven Mile Cañon	......	30	3½	......
Mariposa	J. V. McCurdy	......do	......	15	2	......
Marysville (1)	O'Neale, Rule & Glasier	Lower Gold Hill	......	18	1½	......
Ogden	O. S. Carvill	Virginia	......	20	1½	......
Pacific	Sharon & Co	Lower Gold Hill	1863	50	1¾	18
Petaluma (1)	Greely Bros	......do	......	12	1	9
Piute	M. Livingston	......do	1863	40	1½	14
Rhode Island	Crown Point G. & S. M. Co	Gold Hill	1862	50	¼	15
Rigby's (1)	Rigby & Co	American Flat	......	12	2½	......
Rogers' (1)	Rogers S. M. Co	Seven Mile Cañon	1862	12	3½	......
Sapphire	W. S. Hobart	Lower Gold Hill	1861	28	1	17
Simcooe	A. Bassett & Co	Seven Mile Cañon	......	25	3	......
Stevenson's (1)	C. C. Stevenson	Gold Hill	1860	5	¼	5
Succor (1)	O'Neale, Rule & Co	Lower Gold Hill	......	26	2½	......
Summit	Mason, Carville & Wright	Virginia	(1)	35	1	20
Union	Wm. Kidd	Gold Hill	1861	14	½	8
Winfield	L. A. Booth	Seven Mile Cañon	......	30	3	......
Total 33	......	......	......	846	48¼ 19	263 mills.
LYON COUNTY.						
Bacon	Lowe & Fair	Silver City	1863	30	3	18
Birdsall & Carpenter	Birdsall & Carpenter	Dayton	1865	75	7½	21
Cole & Co	Cole & Co	Johntown	1864	5	5	5
Confidence	Confidence M. Co	Silver City	1861	14	2½	9
Dayton No. 1	Winters, Küstell & Co	Dayton	1861	20	7	10
Dayton No. 2 (1)	......do.........do	......do	1864	30	7	15
Daney	Daney M. & M. Co	3 miles from Dayton	1863	20	6½	10
Eagle	......	Silver City	1864	1½	3	2
Eastern Slope	Stevenson, Winters & Co	Below Silver City	1862	20	3½	11
Eureka	Wheeler, Hurd & Dunker	Carson River, near Dayton	1861	22	6½	11
Excelsior	John Briggs	Johntown	1861	18	5	9
Franklin	Wm. Sharon, agent	Carson River, near Dayton	1861	16	8	11
Gold Cañon Reduction Works.	Wm. Sharon, agent	Silver City	1861	25	3	13
Golden Eagle	O Neale, Rule & Co	Carson River, near Dayton	1861	18	7	13
Illinois	Wm. Sharon, agent	......do.........do	1864	18	7	10
Imperial (Rock Pt.)	Imperial M. Co	......do.........do	1861	90	7	48
Island	O'Neale, Rule & Co	......do.........do	1862	19	7	10
Monitor	Hirschman & Co	Gold Cañon, near Dayton	1865	3	7	3
Ophir (New)	Ophir S. M. Co	Carson River	1864	40	7½	13
Phœnix No. 1 (1)	Hentsch & Berton	Below Silver City	1861	20	3½	10
Pioneer (1)	Sheldon & Hickok	Silver City	1861	23	2¾	12
Sacramento (1)	Hunt, Woodruff & Co	Johntown	1861	18	5	12
San Francisco	Charles Schad	Carson River, near Dayton	1861	14	6½	11
Swansea	W. Sharon, agent	Johntown	1862	20	4½	14

Comstock lode during the year 1866—**Continued.**

Cost per ton hauled.	Cost of water per month.	Tubs.	PANS.				Settlers.	Agitators.	Breakers.	Grinders.	Crushing capacity per month, tons.
			Knox.	Wheeler.	Hepburn.	Varney.					
$1 75	$250	......	......	......	8	......	4	......	......	......	750
......	......	......	26	2	......	......	2	......	......	......	600
......	250	......	......	14	......	......	7	......	......	......	1,400
75	(1) 100	......	(2) 30	......	......	......	......	1	......	......	750
......	(1) 100	......	......	......	(2) 4	......	(2) 4	......	......	......	670
......	75	6	8	......	......	......	......	1	......	......	950
......	350	......	......	......	......	......	......	......	......	......	600
87½	75	......	......	......	......	......	......	1	......	......	415
......	300	......	......	......	8	......	4	......	......	2	700
......	......	......	(1) 20	2	2	......	......	......	......	......	700
1 75	300	......	......	......	......	......	......	......	......	......	*900
75	300	......	......	12	......	......	6	......	......	......	1,000
87½	225	(1) 5	24	......	......	......	4	......	......	......	475
......	......	......	......	......	39	3	21	......	......	......	3,500
1 00	200	......	(1) 24	......	......	......	......	3	......	......	400
75	300	......	74	......	......	......	......	2	......	......	1,100
......	......	......	......	10	......	......	5	......	(B) 1	2	1,000
......	150	......	2	6	......	......	(2) 3	......	......	......	600
......	75	......	......	......	......	......	......	2	......	......	500
......	......	......	......	12	......	......	4	......	......	......	1,000
1 73	400	......	......	15	......	......	(1) 5	......	......	2	1,305
1 00	150	......	18	......	......	......	4	1	......	......	300
1 00	300	......	......	......	12	......	(1) 6	......	......	1	1,900
70	400	......	(2) 13	......	8	......	4	2	1	......	1,350
......	150	......	......	......	......	5	4	......	......	......	400
......	......	......	......	......	......	......	......	......	......	......	360
1 23	250	......	56	......	......	......	2	1	(1) 1	......	850
......	......	2	......	(1) 4	2	......	3	......	......	......	700
1 00	30	......	10	(3) 1	......	......	......	......	......	......	150
......	150	......	......	......	2	......	1	1	......	......	600
1 00	300	......	......	11	......	(2) 1	4	1	......	......	900
1 00	200	14	......	......	......	......	......	1	......	......	400
......	......	......	......	......	8	......	4	......	(B) 1	1	1,000
....	5,380 25 mills.	27	305	91	93	9	101	17	4	8	26,820
2 00	......	......	......	17	......	......	4	2	......	......	......
3 00	......	......	......	20	......	......	(2) 10	5	(B) 1	1	1,900
3 00	......	......	......	4	......	......	2	......	......	......	125
1 75	......	......	......	......	......	8	5	3	......	......	650
3 50	......	......	......	6	......	......	(2) 2	(3) 2	......	......	500
3 50	......	......	......	......	......	8	4	3	......	......	800
3 25	......	$15	......	......	......	......	......	......	......	......	500
2 00	......	......	2	......	......	......	......	......	......	......	40
1 50	......	......	......	......	6	......	(1) 3	1	......	......	550
3 25	......	......	......	10	......	......	5	2	(1) 1	......	1,100
3 00	......	......	18	......	......	......	1	......	......	......	530
4 25	......	5	......	2	2	......	2	......	......	......	500
1 50	......	......	(1) 7	......	6	......	......	......	......	......	†600
3 50	......	......	24	......	......	......	1	......	......	......	500
3 50	......	......	......	......	6	......	2	3	......	......	500
3 00	......	(1) 27	......	......	14	......	(1) 7	3	(B) (2) 1	......	‡2,400
3 00	......	......	......	......	......	8	3	......	......	......	500
3 00	......	......	......	2	......	......	......	......	......	......	75
4 25	......	......	......	......	12	......	6	1	......	......	1,200
2 00	......	......	......	......	......	......	4	......	......	......	500
1 75	......	......	......	......	......	......	......	......	......	......	550
3 00	......	......	......	......	......	......	......	1	......	......	530
3 00	......	7	......	......	3	......	......	......	......	......	500
2 75	......	(1) 22	......	......	......	......	3	......	......	......	600

*Soon will be 1,200 per month.

†750 tons per month; October 15, 1866.

‡Now 2,800 tons.

Tabular list of mills from mines crushing ore on the

Names	Owners.	Location.	When built.	Tons capacity.	Miles from mine.	Men employed.
LYON COUNTY.–Con.						
Trench	Joseph Trench	Silver City	1861	30	2½	15
Weston's (1)	Wm. Weston	Johntown	1862	25	4	15
Weston's (1)	Wm. Weston	do	1862	7	4	4
Total 27				641½		315
				4		
				637½		
ORMSBY COUNTY.						
Brunswick	Williams & Sharon	1 mile below Empire	1863	20	9½	10
Carson	W. Sharon, agent	3 miles west of Carson	1862	11	18	
Merrimac (1)	Rice & Yerrington	1½ mile below Empire	1862	30	9	
Mexican (1)	Alsop & Co	Empire	1862	45	9	
Santiago	Santiago M. Co	4 miles below Empire, on Carson river.	1862	45	8	
Sierra	Beach & Harrington	3 miles west of Carson		9	18	
Vivian	P. Frothingham	3½ miles below Empire	1860	30	9	9
Yellow Jacket	Yellow Jacket M. Co	Empire	1864	90	8½	
Total 8				280		
WASHOE COUNTY.						
Atchison	Savage Co	Washoe	1862	30	14	
Buckeye	Lambert & Co	do	1863	20	14	
Manhattan (1)	New York & Nevada Co	do	1863	45	13	
Minnesota	Savage M. Co	do		30	14	
Napa	James Hill & Co	Galena		15	14	
New York & Washoe	New York & Washoe Co	Washoe	1863	45	14	
Ophir Reduction Works (1.)	Ophir M. Co	Franktown	1862	33	16	43
Temelec	Baldwin & Bonner	Washoe	1865	30	14	
*Washoe Valley Reduction Works.	J. H. Dall	Franktown	1863	60		
Total 9				308		

Comstock lode during the year 1866.—Continued.

Cost per ton hauled.	Cost of water per month.	Tubs.	PANS.				Settlers.	Agitators.	Breakers.	Grinders.	Crushing capacity per month, tons.
			Knox.	Wheeler.	Hepburn.	Varney.					
$1 75	......	......	......	......	......	......	......	......	......	......	800
2 00	......	......	......	9	......	......	5	1	......	......	700
2 00	......	......	......	......	......	......	......	......	......	......	......
......	......	76	51	70	49	24	69	27	3	1	......
......	......	......	......	9	......	......	5	1	......	......	......
......	......	......	......	61	......	......	64	26	......	......	......
4 00	......	......	......	......	......	8	4	......	......	1	800
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	4	15	......	1	(1) 6	10	......	......	1,350
......	......	......	......	......	12	......	......	......	......	......	*1,260
......	......	......	......	14	4	......	9	......	(B) 1	......	1,100
......	......	......	......	......	......	......	......	......	......	......	......
3 75	......	......	......	8	......	......	4	1	(1) 1	......	750
......	......	......	......	......	30	......	15	2	......	2	2,300
......	......	......	4	37	46	9	38	13	2	3	......
......	......	......	......	16	......	......	8	......	1	......	,200
......	......	......	......	8	......	......	......	4	1	......	700
......	......	......	......	......	......	......	8	......	......	1	1,300
......	......	......	......	12	......	......	6	1	1	......	1,000
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	16	8	......	......	1	1,300
......	......	......	......	......	......	......	......	......	......	......	†450
......	......	......	......	12	......	......	(1) 3	......	......	......	800
......	......	......	......	......	......	6	......	......	(2) 2	......	‡1,725
......	......	......	......	48	......	22	33	5	5	2	......

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* By wet process 1,000, and dry 260 tons.

† Full capacity 750 tons.

‡ Wet, 1,050; dry, 675 tons.

NOTES ON MILLS.

STOREY COUNTY.

Bowers (1)—Paid this for 5 months only; has been idle four months; now running, with own water; (2) 5-foot pans.

Central (1)—To Virginia and Gold Hill Water Companies; also, pays $—— to Ophir Company.

(2)—Hepburn and Peterson's, working 500 tons per month wet; four furnaces and six barrels, working 170 tons dry.

Crown Point (1)—Just dismantled; engine used to drain mine.

Comet (1)—Been idle for seven months; just started again.

Douglas (1)—10-inch cylinder, 30-inch stroke, 26 plain pans.

Empire No. 1 (1)—Increasing stamps to 21; capacity to be 40 tons per day; to employ 16 men, 27 Wakelee pans.

Empire No. 2 (1)—Concentrators and two stamps for breaking.

Empire State (1)—4-foot pans.

Gold Hill (1)—6-foot tubs.

Hoosier State (1)—With steam chambers.

Land's (B)—Throughout the table designates Blake's breakers.

Mariposa (1)—Also one prospecting stamp; (2) large.

Marysville (1)—30 5-foot plain pans.

Pacific (1)—Large.

Petaluma (1)—Stamps being increased to 16; capacity to 26 tons per day; men to 11; wood to five cords; adding eight improved Wheeler pans, four settlers and one agitator.

Piute (1)—8-foot settlers.

Rhode Island (1)—18-inch cylinder; (2) 7-foot pans.

Rigby's (1)—One extra pan and settler for tailings and one barrel.

Rogers's (1)—Not running for four months.

Saphire (1)—Wheeler.

Simcoe (1)—Improved.

Stevenson (1)—8½-inch cylinder; (2) Howland's rotary battery; can crush seven tons and amalgamate five tons per day; (3) small.

Succor (1)—24 Wakelee flat-bottomed pans.

Summit (1)—Burnt and rebuilt in 1863; (2) small pan and settler.

LYON COUNTY.

Birdsall (1)—Mill, $110,000; ditch, $40,000; total, $150,000.

Carpenter (2)—Large-sized Wheeler.

Dayton No. 1 (1)—Four of these for prospecting; (2) 8-foot settlers; (3) Knox.

Dayton No. 2 (1)—Two roasting furnaces.

Eastern Slope (1)—Large.

Eureka (1)—Break 80 tons per day.

G. C. Reduction Works (1)—5-foot pans.

Imperial Rock Pt. (1)—7-foot tubs and settlers; (2) breaker, large size.

Phœnix No. 1 (1)—Eight tubs and Wheeler pans.

Pioneer (1)—15 tubs and Wheeler pans.

Sacramento (1)—12 7-foot iron pans.

Swansea (1)—6-foot tubs and one prospecting battery and pan.

Trench (1)—16 flat 7-foot pans, one excelsior and two Wheeler and Randall pans.

Weston's (Steam)—(1)—Worked but about 1,000 tons of Comstock ore this year; hauling about $3 per ton.

Weston's (Water)—(1)—Six flat-bottomed pans; has run but little this year for want of water

ORMSBY COUNTY.

Merrimac (1)—Also, one prospecting battery and pan; (2) large.

Mexican (1)—Four furnaces and 10 barrels.

Vivian (1)—Hanscom's.

WASHOE COUNTY.

Manhattan (1)—16 pans.

Ophir (1)—Working but 36 stamps—Freiberg process—nine furnaces.

Reduction Works—24 amalgamating barrels.

Temelec (1)—Large.

* *Washoe Valley* (1)—Wheeler 12-feet breast; full capacity about 300 horse-power.

Reduction Works—40 stamps used for Freiberg process, and 20 for wet; eight furnaces and 20 barrels for dry process; four Wheeler and Randall's pans for wet; four more Varney pans to be introduced; (2) Blake's improved saw.

Process of Reduction.—The ores from the Comstock lode are probably the most docile silver ores found in Nevada, and the process used for their reduction is of the simplest kind. After crushing by the stamps, the large boulders being first reduced to a moderate size by hand labor or by Blake's patent crushers, the material as it passes from the battery is collected and settled in tanks to avoid as much as possible the risk of fine particles passing off with the superfluous water. In spite of all precautions much loss is sustained from this source, experience showing that the most impalpable of the slum is the richest in proportion. Out of 40,432 tons of ore worked at the Gould & Curry mill 4,431 tons were lost in this manner.

From the tanks the crushed ore is passed to the iron grinding pans, a description of which will be found in preliminary report, pages 76 and 77. The charges vary from 500 to 1,500 pounds, according to the character and capacity of the pans used. In these pans the ore is ground from four to six hours, being in that time reduced to an almost impalpable powder. The mode of treatment varies considerably, some mill men using a variety of chemicals, such as sulphate of iron, muriatic and sulphuric acids, &c., while others dispense with them almost entirely. Their object is to assist the reduction of the silver in combination, but much uncertainty exists as to their beneficial operation. Each charge is invariably mixed with a considerable amount of salt, varying with the richness of the ore. Towards the end of the process the quicksilver is usually added, the mullers of the pans being at the same time slightly raised to prevent the grinding or "flouring" of the mercury. After a sufficient time has elapsed to allow a thorough amalgamation, the pulp is thinned by the addition of water, and revolved in such a way as to allow the amalgam to settle to the bottom. For economy of time, this is usually accomplished in large vats called "settlers," especially adapted for that purpose. The refuse matter is then drawn off and treated by various methods of concentration, to be spoken of afterwards. This process is used only for second and third class ore, it being found better to employ the Freiburg process for first-class ores. The Central mill in Virginia, and the Washoe reduction works and Ophir mill in Washoe valley are the only ones adapted to this method, the amount of ore requiring this treatment being but a small percentage of the entire product of the lode.

Some mill men amalgamate in the battery while the ore is being crushed, but the practice is not by any means universal. In fact, the treatment of ores is in a great measure empirical, but little attention being given in Nevada to analytical chemistry, and the adaptation of the working processes to the results developed. In this connection the following assays or rather analyses of Comstock ores may be found of interest:

Ophir mine—a first-class ore and metal produced therefrom by the Freiburg process, by George Attwood.

Gangue	63.380	.00
Silver	2.786	41.51
Gold	.059	1.58
Lead	4.151	39.01
Antimony	.087	.00
Zinc	14.455	.56
Sulphur	7.919	.00
Copper	1.596	17.04
Iron	5.463	.17
	99.896	99.87

" Ore from California mine, Virginia. No. 1 made in London; No. 2 at Swansea.

	No. 1.	No. 2.
Silica	67.5	65.783
Sulphur	8.75	11.35
Copper	1.30	1.31
Iron	2.25	2.28
Silver	1.75	1.76
Gold	.059	.57
Zinc	12.85	11.307
Lead	[illegible].75	6.145
Loss	.25	
	100.00	100.00

Yellow Jacket ores, second-class; by W. F. Rickard, F. C. S.

	White.		Brown.		Mixed.	
Gold	.005=	$30 03	.001=	$7 52	.002=	$10 04
Silver	.150=	62 83	.050=	21 99	.157=	65 98
Iron	.575		2.800		1.230	
Lead	Traces.		Traces.		Traces.	
Copper	Traces.		Traces.		Traces.	
Sulphur	.693		.160		.457	
Lime	Traces.		.000		Traces.	
Silica	98.310		96.560		97.850	
Loss	.267		.429		.304	
	100.000	$92 86	100.000	$29 51	100.000	$76 02

The difference in the composition of these ores is worthy of notice. The Ophir and California mines are situated in the northern part of the explored portion of the lode, where a much larger percentage of base metal is encountered than elsewhere. These ores are evidently unsuited to the simple process just described. The analysis of Yellow Jacket ores presents a fair sample of the general composition of second and third-class rock from the Comstock mines. It will be seen at a glance that the amount of base metal present is extremely small, the ore consisting almost entirely of sulphuret of silver and iron and native metals.

COST OF REDUCTION.—The following details taken from the published reports of mining companies show a material diminution from the cost in former years, due in great measure to improvements in machinery, systematization of labor, and increased knowledge of the method of reduction:

Savage mine, average for 12 months ending July 1, 1867	$14 04
Savage mine, for the previous year	16 74
Hale & Norcross mine, average for 12 months ending March, 1867	14 26
Gould & Curry mine, average for 12 months ending November, 1866	13 30

The following table, from the report of the Gould & Curry Company, will show the relative proportion of the various items. It will be noticed that the total cost per ton is less than the average given above. This arises from the fact that the company had ores worked at custom mills, the cost of which was greater than at their own mill as given below:

Cost per ton in detail of ore reduced at the Gould & Cury mill.

	Labor.	Wood.	Castings.	Sulphate of copper.	Salt.	Quicksilver.	Sundries.	Total.
Foreman, watchmen, and laborers	$0 71.33	....	....	....	....	....	....	$0 71.33
Driving power	0 58.88	$3 97.84	....	....	....	....	$0 12.49	4 61.21
Breaking ore	0 41.32	....	....	....	....	....	0 03.33	0 44.65
Batteries	0 65.98	....	$0 20.85	....	....	....	0 10.39	0 97.22
Amalgamating	0 76.81	0 04.65	0 59.36	$0 42.50	$0 27.06	$0 8.50	0 10.96	3 08.96
Repairs	0 84.10	....	....	....	....	....	0 69.41	1 53.41
Hauling	....	....	....	....	....	....	0 90	0 90
Totals	3 90.42	4 02.49	0 80.21	0 43.50	0 27.06	0 8.50	1 96.48	12 26.78

Great as has been the decrease in the price of reducing ores since the commencement of operations in Virginia, the construction of a railroad into Virginia from any point on the Truckee river (where fuel is abundant) would result in a still further reduction. In this connection attention is called to the following figures from the last report of the State surveyor general:

STOREY COUNTY.

The table contains a list of 33 mills, all steam, estimated to have cost $2,000,000, with an assessed value for 32 of $953,705, say, for the 33, $970,000, containing 607 stamps, with a crushing capacity of 846 tons per day, nearly 1.4 tons per stamp, consuning 180½ cords of wood per day, average cost about $14 per cord; total, $2,527, or nearly $3per ton, and about $4 15 per stamp.

Twenty-four mills pay the Virginia & Gold Hill Water Company $5,280 per month for water; add water tax, $130 per month; total, $5,410, cost of water per nonth for 24 mills, which contain 399 stamps, with a crushing capacity of 562 tons, or 14,612 tons per month of 26 days. Cost per ton of ore worked for water, 37 cents, or 52 cents pr stamp.

Aggregate distance of 33 mills from the mines about 48½ miles; avenge distance about 1½ mile, (for custom mills the distance is estimated, with one or two exceptions, from the divide between Virginia and Gold Hill;) and the average cost of hauling is about $1¼ per ton, ranging from 70 cents to $2.

846 tons per day for 26 days would equal—

21,996 tons, at $3 for wood	$65,988 00
*21,966 tons, at 37 cents for water	8,127 42
21,966 tons, at $1¼ for hauling	27,457 50
Total per month for wood, water and hauling	101,572 92

or $4 62 per ton.

LYON COUNTY.

Total mills, 27. Steam, 16; water, 8; steam and water, 3. Estimatd cost of 15 steam, 7 water, 3 steam and water mills—$1,464,000.

The 27 mills contain 424 stamps, from which deduct 4 used for prospeting, and we have 420 stamps, with a crushing capacity of 641½ tons per day; from which deduct 1 mill with 10 stamps, capacity 7 tons, which has run but little during the year; also 1 mill with 15 stamps, capacity 25 tons, which has crushed but about 1,000 tons during tle year of Comstock ore; and we have 25 mills with 395 stamps, with a capacity of 619½ tos per day, or 1.57 tons per stamp; using 100 cords of wood per day, costing about $10 per crd. Total, $1,000: equal to $1 61 per ton, or $2 53 per stamp.

The aggregate distance of 25 mills from the mines is about 135 miles: average distance 5.4 miles, and average cost for hauling about $2 75, ranging from $1 50to $4 25.

25 mills employ 315 men, or one man for 1.97 tons.

619½ tons per day for 26 days equal 16,107 tons; add for Weston'st stam mill 93 tons per monthly average; total per month, 16,200 tons.

16,200 tons, at $2 75 per ton for hauling	$44,550 00
16,200 tons, at $1 61 per ton for wood	26,082 00
Total per month for wood and hauling	70,632 00

or $4 36 per ton.

ORMSBY COUNTY

Six water, and two steam and water mills. Estimated cost, $825,000; with 170 stamps, crushing capacity, 280 tons per day, or 1.65 tons per stamp; aggregate distance from mines, 80 miles; average distance, 10 miles; average cost for hauling, say $4 per ton; 11¾ cord of wood at, say, $8 per cord, $94, or 33⅓ cents per ton, or 55 cents per stamp.

280 tons per day for 26 days equal—

6,780 tons, at $4 for hauling	$27,120
6,780 tons, at 33⅓ cents for wood	2,260
Total per month for wood and hauling	29,380

or $4 33 per ton.

WASHOE COUNTY.

Five steam, and four steam and water mills; estimated cost, $794,000; containing 261 stamps; crushing capacity, 308 tons per day, or 1.18 tons per stamp, consuming about 82 cords of wood at, say, $5 per cord; total, $410, or $1⅓ per ton, or $1 57 per stamp.

Average distance of mills from mines, say 14 miles, and average cost of hauling $4 50 per ton.

308 tons per day for 26 days equal—

8,008 tons, at $4 50 per ton for hauling	$36,036 00
8,008 tons, at $1⅓ per ton for wood	10,677 33
Total per month for wood and hauling	46,713 33

or $5 83 per ton.

From these tables it appears when wood is worth in Virginia $14 per cord, the cost of this item per ton of ore reduced is about $3. Any railroad could put wood down at the same mills for $9 per cord, with great advantage to the company. This would be a saving of $5 per cord, or about $1 07 per ton. Making this alteration in the details of Storey county mills, the cost of reduction per ton for the items of wood, water and hauling, the total would be $3 55 per ton, or 81 cents less than the most favorable average results at mills working Comstock ores, or $2 02 less than the most unfavorable. Competent judges estimate that by taking these ores to the Truckee river the total cost of reduction per ton would not exceed about $9 or $10.

Percentage of Yield and Loss.—Experience has shown that for the ordinary ores of the Comstock, 65 per cent. of the assay value of the ore is about the proportion which can be extracted by the process in use, and custom mills are required to return at least that proportion. Careful assays are made daily of the ore as it is raised from the mine, it being customary to take a handful of ore from each car load as it is brought to the surface, and place it in a box placed near the shaft for the purpose. Several times during the day the contents of this sample box are thoroughly mixed and several assays made of them; the average of which will show very nearly the quality of ore being raised at any particular time. In some cases the value of the ore is ascertained by sampling the contents of each wagon load as it leaves the mine, in the manner just described. During the process of reduction, assays are taken of the pulp as it leaves the batteries, which of course from the intimate admixture of the ore will be more reliable, but if amalgamation for free metal in the batteries is adopted, as at some mills, the millman can gain but little idea of what he is doing, as the quantity of metal saved in the batteries is an unknown item, to be ascertained only when a thorough clean up is made. To avoid unnecessary detention from this source, which requires a stoppage of all machinery, this is not done much oftener than about every two weeks. The following tables are valuable in this connection. The statistics from the Hale and Norcross mine may be taken as a fair illustration of the average results of milling operations in this section. It will be noticed that the percentage of gold lost is small compared with the silver, showing the former metal to be present chiefly in an uncombined form. The table suggests some important questions. It shows that we are losing annually about 35 per cent. of the value of the ore mined from the Comstock. The yield of bullion last year was in round numbers, say, $15,000,000, which would show the loss to have been about $8,000,000. The enormous extent of this loss is well understood, but so far no feasible means of lessening it without diminishing the net profits on the result have been suggested, or at least shown to be practicable. Exceptional lots of ore will work nearer to the assay value, but only in rare instances. How small a percentage of the metal which escapes the mill is saved by future operations will appear under the next heading. The great difficulty to contend with lies in the cost of labor and fuel. The average yield of all ores worked at the present time does not probably exceed $35 per ton, equivalent to a loss of $18 90 per ton, supposing $35 to represent 65 per cent. of the assay value of the ores. If by using the Freiburg process we saved 80 per cent., the average yield per ton would be $43 12, or an advance of $8 12, which would not cover the additional cost of labor and fuel. The price charged for treatment by the Freiburg process in this district is $45 per ton, with a guarantee of only 80 per cent. Its non-applicability to low grade ores is at once apparent, the cost of reduction being greater than the average yield of the ores. To make it available, it is evident that the additional 15 per cent. of the assay value saved must cover the increased cost of reduction, which is, say, $31, so that it will prove valuable only when the ores are worth $200 per ton and upwards. In practice a lower grade than that may be adopted, it being found by experience that the percentage of loss in working ores by the net process increases with the greater value of the mineral. Under these circumstances we must look rather to improvements on the present modes of treating the "tailings" from the mill by concentration or otherwise.

HALE AND NORCROSS MINE.

Table showing the assay value of the ore extracted during twelve months operations, also the yield and loss per ton, the percentage of yield and loss, and the entire results.

Ore.	Assay value of ores.				Yield.			Loss.		
	Quantity.		Value per ton.	Total value.	Per ton.	Per cent.	Total.	Per ton.	Per cent.	Total.
	Tons.	*Lbs.*								
First six months—										
Gold	......	......	$24 30	$306,582 90	$20 92	85.8	$263,043 90	$3 46	14.2	$43,539 00
Silver	......	......	40 79	512,895 43	21 30	52.2	267,764 65	19 50	47.8	245,130 78
Total	12,571	1,950	65 18	819,478 33	42 42	64.7	530,808 55	22 96	35.3	288,669 78
Second six months—										
Gold	......	......	29 18	468,734 00	24 90	85.3	400,016 18	4 28	14.6	68,717 82
Silver	......	......	51 64	829,524 11	26 42	51.2	424,395 67	25 22	48.8	405,128 44
Total	16 064	30	80 82	1,298,258 11	51 32	63.5	824,411 85	29 50	36.5	473,846 26
Total for 12 months—										
Gold	......	......	27 07	775,316 90	23 15	85.5	663,060 08	3 92	14.5	112,256 82
Silver	......	......	46 88	1,342,419 54	24 17	51.6	692,160 32	22 71	48.4	650,259 22
Total	28,635	1,980	73 95	2,117,736 44	47 32	63.9	1,355,220 40	26 63	36.1	762,516 04

NOTE.—This table is copied from records on file in the office of the company. The original, prepared by Mr. Thompson, was marked out to six places of decimals for the cents. The omission of these will account for its apparent trifling discrepancies.

GOULD AND CURRY MINE.—Table showing the average value of the ore reduced during the year ending November 30, 1866, the yield at the mill and the loss per ton. (G. & C. annual report for 1866:)

Average assay per ton		$43 95
Average yield per ton, 75 per cent		33 02
Average loss per ton, 25 per cent		10 93
Total value of ore as per assay		$1,582,247 43
Bullion produced:		
Gold	$363,803 92	
Silver	825,277 85	
		1,189,081 77
Total loss, about 25 per cent		393,165 66

NOTE.—This table does not show the entire yield of the mine for the year, large quantities of ore being reduced at "custom mills." The statement refers only to ores reduced at the large mill owned by the Gould and Curry Mining company.

CONCENTRATION.—Concentration is employed only in the treatment of the "tailings," or sands from which all the metal has been extracted which could be saved in the mill. The tailings are usually turned into the nearest watercourse, (many mills being so situated as to have no facilities for the construction of reservoirs,) and the right to use them rented to other parties. Many plans have been suggested for their concentration, but the one in general use is extremely simple. It consists merely in passing the sands through shallow sluice boxes, the bottoms of which are covered with thick blankets. The fall of these sluices is considerable to prevent packing of the sands, but the stream of water is regulated so as to cover the blankets with a thin sheet only. In this way the heavy metalliferous particles are retained in passing over the rough surface of the blankets, the lighter sands passing off in the water. After a sluice box has been running several hours, the water is turned off, the blankets washed in a tank of water, and returned to their places. This constitutes the entire treatment. When the tank is nearly full of tailings, it is emptied and the resulting mass considerably increased in value by the elimination of waste sands, is ground and amalgamated in the manner already described. Latterly this has become quite an extensive branch of our mining business, and is said to yield a good return on the capital employed.

The following items are taken from the report of the surveyor general for 1866:

Details of blanket washings in Six-mile cañon for 1866 and 1867.

Number of mills discharging tailings into the cañon, 12.
Probable number of tons worked during the year 1866, 100,000.
Estimated value of tailings saved and worked in 1866, $72,000.
Saving per ton of ore worked, 72 cents.
Length of sluices, 22,000 feet.
Cost of sluices, $20,000.
Estimated value of tailings saved and worked in 1867, $164,000.
Saving per ton of ore worked in 1867, $1 64.
Average value of tailing saved per ton, $20.

These items show only a portion of the operations. The total value of all tailings saved in this manner was probably about $200,000 for 1866, which will be doubled for 1867. These figures can only be considered approximations, but they serve to show how small a percentage of the gross loss is saved by these means, and how large a field is yet open for improvement.

SECTION XVII.

YIELD OF THE MINES, NET PROFITS, ETC.

The following tables, taken from the circular of the San Francisco Stock and Exchange Board, will be found of interest in this connection:

Table of the products of some of the principal mines in Virginia and Gold Hill; also showing dividends paid and assessments levied on the same during the year 1866.

Company.	Bullion produced.	Dividends.	Assessments.
Lady Bryan	....	....	$15,000
Daney	....	....	26,000
Sierra Nevada	....	....	55,500
Ophir	$450,000	....	184,800
Gould & Curry	1,605,228	$252,000	....
Savage	1,805,800	360,000	....
Hale & Norcross	1,199,768	350,000	....
Chollar-Potosi	848,750	....	....
Bullion	....	....	175,000
Exchequer	....	....	32,000
Alpha	....	....	144,560
Imperial	910,167	176,000	....
Empire	486,778	32,400	....
Bacon	....	....	18,000
Confidence	303,920	....	78,000
Yellow Jacket	2,310,000	390,000	160,000
Crown Point	1,313,357	234,000	....
Belcher	....	....	143,520
Overman	27,953	....	208,000
Baltimore American	....	....	13,000
Total	11,261,741	1,794,400	1,273,380

Production of bullion by Storey county during the year ending December 31, 1866.

January	$816,430 43
February	971,643 46
March	1,061,577 65
April	1,052,759 89
May	1,145,293 41
June	1,244,297 54
July	1,198,741 56
August	1,420,902 35
September	1,169,391 46
October	1,409,220 00
November	1,327,985 00
December	1,348,828 80
Total	14,167,071 55

In United States currency this represents a value of $18,072,934, on which federal taxes were paid as follows:

From January to July, inclusive, $\frac{6}{10}$ of one per cent. on $9,402,062	$56,412 37
From August to December, inclusive, $\frac{1}{2}$ of one per cent. on $8,670,872	43,354 36
Total tax	99,766 73

Production of bullion in Storey county for the first seven months of 186[illegible]

January	$1,330,832 80
February	1,233,811 63
March	979,786 78
April	1,567,427 60
May	1,784,724 25
June	1,594,794 22
Total	8,501,377 28
July	1,613,559 75
Total	10,114,937 03

NOTE.—The month of March was characterized by the most severe snow-storm which has yet been experienced in Virginia. The roads were nearly impassable for two weeks—to such an extent, indeed, that firewood rose from $16 to $45 per cord, and was scarcely obtainable even at that price. The mills situated at some distance from the mines were entirely cut off from new supplies of ore, and reduced only such reserve as had been accumulated; hence the marked diminution in the monthly production of bullion.

Table of assessments levied on Comstock mines during the first six months of 1867.

Company.	1st quarter.	2d quarter.
Baltimore American	$5,200	....
Belcher	28,080	$15,600
Bullion	25,000	50,000
California	....	30,600
Confidence	39,000	1,300
Ophir	84,000	....
Overman	32,000	....
Sides	1,500	14,000
Sierra Nevada	12,000	42,000
	226,780	153,500 226,780
Total for six months	....	380,280

Dividends of leading claims on the Comstock lode.

SECOND QUARTER IN 1867.

Company.	April.	May.	June.	Total.
Savage	$80,000	$120,000	$160,000	$360,000
Hale & Norcross	50,000	50,000	50,000	150,000
Imperial	60,000	60,000	40,000	160,000
Yellow Jacket	....	60,000	90,000	150,000
Chollar-Potosi	....	70,000	70,000	140,000
Kentuck	....	40,000	60,000	100,000
Crown Point	48,000	48,000	....	96,000
Gold Hill Q. M. & M. Co	5,000	5,000	5,000	15,000
Empire Mill and Mining Co	....	7,200	....	7,200
Gould & Curry	....	....	....	....
Total	243,000	460,200	475,000	1,178,200
First quarter 1867	....	....	....	790,000
Total since January, 1867	....	....	....	1,968,200

Dividends of the leading claims on the Comstock lode—Continued.

SECOND QUARTER OF 1866.

Savage				
Hale & Norcross	$20,000	$20,000	$20,000	$60,000
Imperial		40,000		40,000
Yellow Jacket				
Chollar-Potosi				
Kentuck				
Crown Point	48,000	48,000	48,000	144,000
Gold Hill Q. M. & M. Co.				
Empire Mill and Mining Co.				
Gould & Curry	96,000		96,000	192,000
Total	164,000	108,000	164,000	436,000
First quarter 1866				90,000
Total since January, 1866				526,000

The aggregate yield of the Comstock lode since its opening has been so fully spoken of in the preliminary report, that I shall here confine myself chiefly to a comparison of the operations of 1866 with the first six months of the present year.

Although the first table does not show the entire yield of the mines for 1866, which reached, as shown elsewhere, the sum of $14,167,071, it will answer as a basis for an inquiry into the actual profits of mining enterprises in this district for the year, inasmuch as mines owned by private companies, the returns of which are not madepublic, are generally worked only while they prove profitable, or at any rate yield sufficient bullion to cover the actual expenses of their development.

By striking out of the assessment table the items relative to the Lady Brian and Daney mines, which are not on the Comstock lode, we have the following result:

Dividends paid during 1866	$1,794,400 00
Assessments paid during 1866	1,232,380 00
Net profit for the year 1866	562,020 00

Equal to about five per cent. of the gross yield of the mines under consideration. The table shows, however, that out of the 11 mines producing bullion, only seven realized sufficient over working expenses to warrant them in distributing the surplus to the stockholders in the form of dividends. These dividends show the net profits of the seven mines for the year 1866 to be the following percentage of the gross yield. Gould and Curry 15.5, Savage 20, Hale and Norcross 29, Imperial 19, Empire 6.5, Yellow Jacket 9, and Crown Point 17.

The first six months of 1867 show a very marked improvement on 1866; for there is not only an actual decrease in the amount of assessments levied, but an increase in the number of dividend-paying mines, a very great advance on the production of bullion, and a really gratifying improvement in the percentage of profit on the gross operations.

From the tables it will be seen that during this period dividends were distributed to the amount of $1,968,200, from which deduct the assessments of $380,280, and there remains $1,587,920 as the net profit on $7,064,653, or about 22 per cent., against five per cent. for the year 1866. This result is due to many causes, among which may be mentioned freedom from litigation, final settlement of conflicting interests, reduced cost of milling, and small expenditures for necessary outside improvements. In 1866 the latter item was unusually heavy. To such causes as these may we look for the improved financial condition of mining interests on the Comstock lode.

The actual profits on the capital invested in our mines is a difficult question to approach, surrounded as it is by so many uncertain and fluctuating conditions, and has probably been spoken of in the preliminary report, as fully as the information at command will allow.

The San Francisco Bulletin gives the following figures showing the aggregate gain in the market value of 15 of our leading mines during the past year:

Company.	July 1, 1866.	January 1, 1867.	July 1, 1867.
Alpha	$249,600	$150,000	$493,200
Belcher	172,640	137,280	457,600
Bullion	142,500	72,500	82,500
Chollar-Potosi	540,400	585,200	1,260,000
Confidence	99,840	96,080	99,840
Crown Point	570,000	750,000	1,086,000
Empire Mill	168,000	240,000	224,400
Gould & Curry	840,000	804,000	846,000
Hale & Norcross	600,000	1,000,000	1,240,000
Imperial	412,000	528,000	1,040,000
Ophir	308,000	198,800	532,000
Overman	76,800	64,000	736,000
Savage	720,000	1,672,000	3,640,000
Sierra Nevada	6,000	9,000	25,500
Yellow Jacket	834,000	1,488,000	1,920,000
Total	5,739,780	7,794,860	13,683,040

Using the valuation for July 1, 1867, the dividends paid during the first six months of 1867 (deducting assessments) would show a profit on the gross operations at the rate of rather more than 23 per cent. per annum for this period. The majority of our mining stocks are held, however, for purely speculative purposes, and fluctuate in value so greatly and incessantly that such a calculation is of little value, most stockholders depending for their profits on sudden rises in the value of their property, caused by favorable developments or skilful "manipulation," rather than on the dividends paid out of the product of the mines. These have been looked upon too much in the light of means by which to "bull" stocks, and too little thought has been bestowed by stockholders on the means by which they have been obtained.

Instances are not wanting where they have been paid out of borrowed capital, and in many cases they have been made only by working the mine in a ruinous manner. Many thousand tons of rock have been worked during the past year, which ought never to have been taken from the mines until such time as it could be worked more cheaply than at present. Had the stockholders of the mining companies looked to the actual profits of mining enterprises for their remuneration, they would have extended to railroad matters a helping hand, and could have been realizing to-day on low-grade ores a profit of $10 or $12 per ton, instead of $4 or $5. The fear of temporarily reducing the value of their mining stocks by granting such assistance has always stood in the way. The absolute necessity, however, of better modes of transportation has at length been realized, and before the expiration of another year we shall have the means of greatly reducing the cost of mining and milling operations at our command, and so increasing the amount of our legitimate profits.

The Costs and Losses in Silver Mining.—There are few facts connected with the development of the mineral resources of the country that deserve more immediate attention than the costs and losses which attend gold and silver mining.

The following tables, compiled with the greatest care, exhibit details connected with the subject of silver mining in a form more convenient for reference than an elaborately written treatise. The accounts of the mine named have been selected for compiling these tables because they were more convenient and correct than any others at our command, and because this mine affords a fair sample of a well-managed enterprise in Nevada.

Similar tables have not been prepared for gold mining, because the books of no gold mining company afford the necessary data for their compilation.

Table No. 1 is a complete balance sheet of this company's operations for six months, exhibiting every detail of its expenditure for that period, divided under appropriate heads. This table explains the numerous expenses attending silver mining, the excessive cost of material and labor, and the large proportion of non-productive work necessary to be done in developing a mine.

Table No. 2 shows the proportions of the precious metals saved and lost; gives the names of the various mills at which the ore was worked. This portion of the subject is very suggestive, as exhibiting the fact that some of these mills return a larger per cent. of metal than others. This table also exhibits the varying proportions of gold and silver in the bullion saved by the various mills, which appear to be influenced by the processes used for its extraction. This important feature in the table would have been more valuable had the books of the company shown the depths and localities from whence the ore reduced had been extracted.

It is suggestive also to mark that the loss of metal, according to assay, foots up $471,155 17, while the total quantity saved only amounts to $816,979 62, out of $1,288,132 79. Of 32 lots sent to mill, only two returned over 70 per cent. of the fire assay value; this, too, in one of the best managed companies, and when the mills are boasting of the improvements in their machinery and processes. What must have been the waste during the early days of silver mining, before the present incomplete experience had been attained?

That the present enormous waste of the precious metals by custom and company's mills might be avoided, is clearly demonstrated by the success of the companies which re-work the tailings thrown away by these mills. In the vicinity of Virginia City there are several miles of flumes, all lined with blankets, which require hundreds of men to change every few hours. The tailings thus collected yield a larger profit, according to the cost of their production, than the ores worked in the mills. Nearly one-third of the bullion shipped from Storey county, Nevada, is obtained from the waste of the mills collected in these flumes.

Table No. 3 shows the total product of this mine for a year; exhibits the percentum of metal to the ore; the costs of production and reduction. It is hoped these tables will be carefully studied, as they contain much valuable information conveniently arranged for reference.

TABLE No. 1.

Detailed statement of the cost of production of 29,404$\frac{1830}{2000}$ *tons of ore during the year ending March* 1, 1867, *by the Hale and Norcross Silver Mining Company of Nevada.*

MANAGERIAL.	
SALARIES.	
Officers:	
Superintendent	$4,753 28
Clerk	2,277 48
Total	7,030 76
Office expenses:	
Telegrams	$52 80
Newspapers	15 50
Petty cash	16 25
Papering	19 80
Repairing clock	10 00
Express charges	25 70
Miscellaneous	3 50
Total	143 55
Materials consumed:	
5¾ cords of wood	$74 75
2 brooms	2 00
SALARIES—Continued.	
Materials consumed:	
Stationery	$434 60
Total	511 35
Team expenses:	
Horse-hire	$120 00
Hay and grain	229 90
Horse shoeing	26 75
Repairing buggy	25 00
Total	401 65
Personal property:	
Office furniture	$172 69
1 stove	12 25
18 towels	12 00
1 banner	$120 00
1 horse	350 00
1 buggy and robes	560 00
2 horse blankets	17 00
Total	1,243 94
Total managerial	$9,331 25

Detailed statement of the cost of production, &c.—Continued.

SUMMARY.

Salaries	$7,030 76
Office expenses	143 55
Materials	511 35
Team expenses	401 65
Personal property	1,243 94
Total	9,331 25

HOISTING.

HOISTING DEPARTMENT.

Materials consumed:	
2,665 pounds tallow	$296 78
44 pounds machine oil	11 00
36 pounds sulphur	18 00
60 pounds spur yarn	24 00
133 pounds white lead	35 25
98 yards duck	131 35
19 brooms	20 00
Rope and freight	2,053 69
Hardware	1,119 00
Total	3,707 07
Lights:	
300 gallons coal oil	$366 75
13 dozen chimneys	63 29
12 reflectors	48 87
17 dozen wicks	14 26
8 gross matches	19 40
Total	512 57
Cars, cages, &c.:	
1,828 pounds iron for cars	$227 50
247 pounds nuts	60 68
653 bolts	187 76
52 gross screws	138 27
3,303 pounds iron for cages	462 42
811 pounds steel for cages	150 33
1,020 bushels charcoal	336 60
2,046 pounds stone coal	132 11
61 pounds borax	27 80
Total	1,723 47
Personal property:	
9 yards matting	$13 50
15 lamps	86 00
24 fire-buckets	17 00
1 clock	25 00
1 set stocks and dies	15 00
Total	156 50
Labor:	
Brakeman, 1,415½ days	$6,186 00
Blacksmith, 665 days	2,810 00
Carman, 730½ days	3,176 00
Pitman, 1,078½ days	4,314 00
Total	16,486 00
Outside works:	
7,500 feet timber	$210 00
17 shovels	34 00
12 pick handles	5 50
2 sledges	$10 00
Laborers, 585½ days	2,342 83
Total	2,602 33
Total hoisting department	$25,187 94

ENGINE DEPARTMENT.

Materials consumed:	
1,916½ cords wood	$26,770 16
93 gallons lard oil	295 95
103 pounds rubber packing	179 13
31 pounds hemp packing	14 75
316 pounds soap and soda	55 95
38 gallons oil and turps	8 25
6 pounds sponges	20 73
1 gallon varnish	8 00
Sundries	3 00
Total	27,355 92
Auxiliary:	
Water, 1 year	$2,767 50
Hardware	701 03
171 files	117 00
Total	3,585 53
Pump:	
Foundry bill, pump, &c	$1,565 96
77 feet pipe	462 00
362½ pounds pump leather	130 87
2 hides	8 00
Total	2,166 83
Repairs:	
Mason work	$101 05
Machine work	940 63
Freight	238 30
Foundry bill	1,437 25
Boiler work	862 80
Total	3,580 03
Labor:	
Engineers, 756½ days	$4,673 00
Wood passer, 365 days	1,460 00
Pumpman, 365 days	2,190 00
Total	8,323 00

SUMMARY.

Hoisting department:	
Materials consumed	$3,707 07
Lights	512 57
Cars, cages, &c	1,723 47
Personal property	156 50
Labor	16,486 00
Outside works	2,602 33
Total	25,187 94
Engine department:	
Materials consumed	$27,355 92
Auxiliary expenses	3,585 53
Pump	2,166 83
Repairs	3,580 03
Labor	8,323 00
Total	45,011 31
Total hoisting	70,199 25

Detailed statement of the cost of production, &c.—Continued.

MINING.

PROSPECTING AND DEAD WORK.

Prospecting.			Materials consumed.				Labor.				
Location.	Feet run.		Timber.		Lagging.		Miners.		Carpenters.		
Name of drift.	Drift.	Winge.	Feet.	Amount.	Pieces.	Amount.	Days.	Amount.	Days.	Amount.	Total.
400 foot	450	......	10,770	$368 45	1,257	$251 40	......	....	21	$105 00	....
535 foot	865	......	20,760	726 60	2,422	484 40	1,038	$4,152 00	41	205 00	....
Do	......	211	5,060	177 10	591	118 20	252	1,008 00	10	50 00	....
700 foot	980	......	47,040	1,646 40	3,920	784 00	1,152	4,608 00	94	470 00	....
Do	......	261	6,265	219 27	728	145 60	312	1,248 00	12	60 00	....
Incline	125	......	37.500	1,312 50	352	62 20	420	1,680 00	85	425 00	....
780 foot	378	......	9,000	315 00	1,050	210 00	30	120 00	18	90 00	....
Totals	2,798	472	136,395	4,765 32	10,320	2,055 80	3,204	12,816 00	281	1,405 00	$21,042 12

DEAD WORK.

Work done.		Materials consumed.				Labor.				
		Timber.		Lagging.		Miners.		Carpenters.		
Character.	Location.	Feet.	Amount.	Pieces.	Amount.	Days.	Amount.	Days.	Amount.	Totals.
Retimbering	Vein	10,000	$350 00	1,170	$234 00	125	$500 00	26	$156 00	$156 00
Repairing	700 foot	5,000	175 00	830	166 00	53	212 00	....	....	400 00
Do	Incline	6,200	217 00	......	....	108	432 00	....	....	....
Do	535 foot	3,600	126 00	......	....	50	200 00	....	....	868 00
Filling in	Vein	....	....	......	....	480	1,920 00	....	....	3,264 00
Totals	....	24,800	868 00	2,000	400 00	816	3,264 00	26	156 00	....

PROSPECTING—ADDITIONAL EXPENSES.

Materials consumed:	
268 boxes candles	$1,474 00
87 gallons lubricating oil	129 20
1,070 bushels charcoal	353 26
8 kegs powder	49 00
875 feet fuze	25 50
5 sets car wheels	162 50
186 pick handles	116 25
36 sledge handles	18 00
Total	2,387 71
Tools:	
57 shovels	$114 00
9 sledges	45 00
22 picks, old	14 00
280 pounds steel for picks	80 00
Total	253 00
Labor:	
Carmen, 981 days	$3,924 00
Blacksmiths, 285 days	1,710 00
Total	5,634 00
Auxiliary:	
3 casks	$10 50
12 rubber coats	108 00
Ice	131 90
Total	250 40

PROSPECTING—Continued.

Contracts:

Contractor.	Location.	Feet run.	Amount.
E. D. Owens	400 feet level.	430	$2,952 00
E. D. Owens	700 feet level.	40	192 00
T. Cassins	780 feet level.	20	140 00
E. D. Owens	780 feet level.	371	2,230 00
Total	....	861	5,514 00

Summary of prospecting:	
Miners, 3,204 days	$12,816 00
Carpenters, 281 days	1,405 00
Carmen, 981 days	3,924 00
Blacksmiths, 285 days	1,710 00
Timber, 136,395 feet	4,765 32
Lagging, 10,320 pieces	2,055 80
Additional materials	2,387 71
Additional tools, &c	253 00
Additional, auxiliary	250 40
Total	29,567 23
Summary of dead work:	
Miners, 816 days	$3,264 00
Carpenters, 26 days	156 00
Timber, 24,800 feet	868 00
Lagging, 2,000 pieces	400 00
Total	4,688 00

Detailed statement of the cost of production, &c.—Continued.

PROSPECTING—Continued.

Contracts:	
861 feet running	$5,514 00
Total prospecting and dead work	$39,769 23

EXTRACTING ORES.

Materials consumed:	
511,813 feet timber	$14,339 76
536 boxes candles	2,969 87
62½ kegs nails	908 92
81 gallons lubricating oil	179 60
1,121 bushels charcoal	398 25
5,820 pounds iron tacks	727 50
4,600 pounds turntable	529 00
3,113¾ pounds cars	367 15
40 gross screws	90 00
10 sets car wheels	300 00
2 sets incline wheels	130 00
7 brooms	7 00
Total	20,938 05
Tools, &c.:	
115 shovels	$175 30
16 sledges	91 13
16 axes	33 50
19 saws	75 75
16 hoes	16 21
7 wheelbarrows	62 50
454 tool handles	276 50
470 pounds steel for picks	120 00
Total	850 89
Labor:	
Miners, 14,938½ days	$59,852 00
Head miners, 614 days	3,625 50
Carmen, 1,963 days	7,852 00
Carpenters, 838 days	4,463 50
Blacksmiths, 326 days	1,357 00
Foreman, 365 days	2,229 00
Total	79,379 00
Summary extracting ore:	
Materials	$20,938 05
Tools	850 89
Labor	79,379 00
Total	101,167 94
Mining recapitulation:	
Extracting ore	$101,167 94
Prospecting	29,567 23
Contracts	5,514 00
Dead work	4,688 00
Total	140,937 17

IMPROVEMENTS.

FAIR SHAFT.

Real estate:	
16 lots and expenses	$1,970 50
1 stable	70 00
1 tract and expenses	2,258 50
Closing F street	100 00
Moving dwelling	85 00
Total	4,484 00
Materials consumed:	
127,015 feet timber	$3,806 46
15½ kegs nails	208 50
11 gross screws	31 55
1 cord wood	14 00
1 box candles	5 50
112 bushels charcoal	40 32
2,411 pounds iron	327 90
201½ pounds nuts, &c	47 69
3 kegs powder	21 00
300 feet fuse	8 50

FAIR SHAFT—Continued.

Materials consumed:	
1 gallon boiled oil	$2 50
1 quire emery paper	1 50
1,750 bricks, &c	42 00
43½ pounds packing	48 06
30 pounds white lead	7 00
Chalk and line	3 00
Stationery	23 00
Total	4,638 39
Materials on hand:	
8 windows	$44 00
102 bolts	39 66
12 coach screws	3 84
30 tool handles	15 59
20 feet belting	19 20
3 brooms	3 00
7 pairs hinges	13 15
8 locks and latches	8 50
Rope	947 73
482 pieces pipe and joints	189 88
1 iron tuyere	8 50
Total	1,293 31
Engine adjuncts:	
2 reels	$258 00
1 pump	135 00
Boxes, collars, &c	59 70
1 valve	9 00
6 flanges, &c	7 25
8 cocks	32 00
1 steam stop	3 50
1 oil cup	10 00
Total	534 45
Labor:	
Foreman, 36 days	$216 00
Machinist, 16½ days	99 00
Masons, 6 days	34 50
Blacksmiths, 54 days	272 00
Carpenters, 264½ days	1,330 75
Miners, 82 days	328 00
Laborers, 367¾ days	1,471 00
Total	3,751 25
Contractor	$300 00
Materials used:	
1 grindstone	$37 12
1 shaft hook	30 00
1 set bellows, &c	100 00
7 wheelbarrows	102 00
2 sets car wheels	60 00
1 hoisting cask	8 00
1 can	1 25
3 lanterns	6 50
14 pieces furniture	60 25
Total	405 19
Tools, &c.:	
20 shovels	$40 00
33 picks	122 50
4 sledges	17 00
4 axes	10 25
14 durable tools	53 88
2 saws	11 25
25 files	17 75
1 paint brush	2 50
53 assorted brushes	20 00
186 pounds steel	46 50
Total	341 63
Incidental expenses:	
Hauling	$107 50
Advertising	4 00
Total	111 50

Detailed statement of the cost of production, &c.—Continued.

FAIR SHAFT—Continued.

Summary:		
Real estate		$4,484 00
Materials consumed		4,638 39
Materials on hand		1,293 31
Engine adjuncts		534 35
Labor		3,751 35
Contractor		300 00
Materials used		405 12
Tools, &c		341 63
Incidental expenses		111 50
Total		15,859 65

MISCELLANEOUS.

Real estate:		
Superintendent's residence		$1,050 00
Repairing ditto		271 04
Total		1,321 04
Ore house:		
22,700 feet timber		$794 50
19,000 shingles		167 00
6 kegs nails		84 00
830 pounds iron chutes		91 30
Total		1,136 80
Labor:		
Carpenters, 45 days		$225 00
Blacksmiths, 19 days		114 00
Laborers, 20 days		80 00
Total		419 00
Scales:		
6,000 feet timber		$168 00
1,240 pounds iron		130 60
½ of a keg spikes		4 00
2 gross screws		20 00
24 coach screws		7 20
Total		329 80
Labor:		
Carpenters, 15 days		$75 00
Blacksmiths, 8 days		48 00
Laborers, 24 days		96 00
Total		219 00
Expenses:		
Freight		$71 01
Sundries		20 00
Total		91 01
Summary of improvements:		
Fair shaft		$15,859 65
Real estate		1,321 04
Ore house		1,555 80
Scales		639 81
Total improvements		19,376 30

RELATIVE.

CLASSIFICATION.

Weighing:		
Scale cards	$99 00	
Regulating scales	7 50	
Cash paid for weighing	3 36	
Overman, 396 days	1,608 00	
Macadamizing	96 00	
Total	1,813 86	
By receipt for weighing	47 28	
		$1,766 08
Sampling:		
10 cords wood	130 00	
6 yards oil cloth	9 00	
Twine, paper, &c	34 25	
24 sample bags	5 00	

CLASSIFICATION—Continued.

Tools:		
3 shovels	$6 00	
2 brooms	2 00	
3 brushes	4 25	
Incidental expenses:		
Assaying	2,306 00	
		$2,496 50
Total weighing and sampling		4,262 58
Auxiliary expenses:		
Surveying		$500 00
Hauling		134 25
Premium on coin		2,012 01
Assaying bullion	$8,827 69	
Less clips	605 90	
		8,221 79
Total		10,868 05
Taxes:		
Federal bullion		$7,239 83
State bullion		2,189 70
City bullion		203 20
State and county property		1,023 62
City property		346 43
Federal license		7 50
Total		11,010 28
Contingent expenses:		
Law expenses, fees, &c		$250 00
Maps		55 00
Miscellaneous		51 80
Subscriptions		250 00
Medical attendance		133 00
Gratuity to Mrs. Farge		387 00
Brandy and whiskey		53 50
Total		1,180 30
Summary:		
Weighing and sampling		$4,262 58
Auxiliary expenses		10,868 05
Taxes		11,010 28
Contingent expenses		1,180 30
Total relative expenses		27,321 21

TOTALS.

RECAPITULATION.

Managerial cost		$9,331 25
Hoisting expenses:		
Hoisting department	$25,187 94	
Engine	45,011 31	
		70,199 25
Mining expenses:		
Prospecting	29,081 23	
Contracts	5,514 00	
		34,595 23
Dead work	4,688 00	
Extracting ore	101,167 94	
		105,855 94
Improvements—cost:		
Fair shaft, total expenses	15,859 65	
Real estate purchased	1,321 04	
Ore house and scales	2,195 61	
		19,376 30
Relative expenses:		
Weighing and sampling	4,262 58	
Auxiliary expenses	10,868 05	
Taxes	11,010 28	
Contingent expenses	1,180 30	
		27,321 21
Total cost of production		266,679 18

TABLE No. 2.

Comparative tabular statement of the production, loss from assay value, per centum, and proportion of the bullion saved from 15,639 *tons of ore by the Hale & Norcross Company.*

Date of working.	Mills at which reduced.	Quantity reduced.		Assay value.			Amount produced.		
				Gold.	Silver.	Ores.	Gold.	Silver.	Bullion.
1866.		*Tons.*	*Pounds.*						
September	Weston's	370	975	$10,059 91	$17,604 84	$27,664 75	$8,224 70	$9,064 89	$17,289 59
	Brunswick	630	925	16,929 90	27,732 31	46,722 21	15,016 32	15,871 71	30,888 03
	Mariposa	155	995	4,545 98	7,955 54	12,501 52	3,758 92	3,198 17	6,957 09
	C. Land's	839	905	27,956 48	42,974 88	70,931 36	21,987 01	26,224 66	48,211 67
	Summit	750	1	24,543 70	40,899 93	65,443 63	21,178 30	22,981 99	44,160 29
October	C. Land's	1,003	555	35,357 41	65,464 99	100,822 40	33,487 50	34,261 75	67,749 25
	Summit	625	8	22,370 96	38,955 95	61,326 91	19,882 96	19,083 13	38,966 09
	Brunswick	554	67	14,666 12	25,266 11	39,932 23	14,075 34	12,306 31	26,381 65
	Rigley & Co.	404	13	10,405 26	18,261 09	28,666 35	9,041 94	8,950 67	17,992 61
November	Eureka No. 1	239	535	6,048 79	9,577 94	15,626 73	5,765 42	4,389 92	10,155 34
	Eureka No. 2	506	59	16,713 31	29,369 64	46,082 95	14,440 32	13,377 23	27,817 55
	Summit	201	33	9,621 05	12,779 83	22,400 88	7,280 09	6,224 37	13,504 46
	C. Land's	1,042	47	36,695 42	63,472 48	100,167 90	29,493 24	32,616 44	62,109 68
	Brunswick	608	235	14,292 34	26,031 28	40,323 62	13,819 42	11,605 97	25,425 39
	Rigley & Co	505	775	16,527 22	28,710 24	45,237 46	14,660 51	13,361 95	28,022 46
December	Rigley & Co	123	14	3,612 61	6,134 98	9,747 59	3,859 29	3,165 57	7,024 86
	Brunswick	496	435	13,998 58	24,078 39	38,076 97	11,298 90	11,427 20	22,726 10
	C. Land's	1,118	22	33,447 03	57,029 54	90,476 57	25,821 81	29,719 81	55,541 62
	Winfield's	1,027	215	30,127 00	53,657 76	83,784 76	21,073 22	24,769 61	45,842 83
1867.									
January	Winfield's	155	45	5,782 19	10,465 49	16,247 68	5,577 80	4,950 73	10,528 53
	Brunswick	509	363	16,470 58	28,833 24	45,303 82	13,691 17	12,881 21	26,572 38
	C. Land's	969	605	30,084 36	52,923 44	12,684 94	26,807 50	26,727 22	53,534 72
	Union	112	76	2,875 54	5,260 40	20,951 48	2,139 43	1,667 27	3,806 70
	Ophir	36	415	3,908 24	8,776 24	8,135 17	2,637 40	5,493 99	8,131 39
February	Brunswick	353	7	6,982 07	13,969 10	60,671 48	6,976 06	7,853 23	14,829 29
	C. Land's	970	1	19,896 26	40,775 22	10,819 20	18,010 31	22,465 45	40,475 76
	Eureka No. 1	202	455	3,493 73	7,325 47	9,918 89	3,464 28	3,840 57	7,304 85
	Union	144	188	3,212 55	6,706 34	17,687 89	2,545 18	2,575 93	5,121 11
	Ophir	42	325	5,859 61	11,828 28	37,359 18	3,018 20	6,423 32	9,423 52
	Bacon's	617	258	12,358 51	25,000 67	83,007 80	11,679 11	14,643 79	26,322 90
	New York	240	13	4,541 56	9,389 30	13,930 86	4,506 85	5,211 77	9,718 62
	Woodward's	100	68	1,745 87	3,731 74	5,477 61	1,941 49	2,501 90	4,443 39
Total		15,639	36	465,190 14	822,942 65	1,288,132 79	397,157 99	419,819 63	816,977 62

TABLE No. 2.—*Comparative tabular statement of the production, loss from assay value, &c.*—Continued.

Date of working.	Mills at which reduced.	Quantity reduced.		Amount lost.			Percentage extracted.			Excess of production.	
				Gold.	Silver.	Ores.	Gold.	Silver.	Bullion.	Gold over silver.	Silver over gold.
		Tons.	*Pounds.*								
1866. September	Weston's	370	975	$1,835 21	$8,539 95	$10,375 16	$0 81.75719	$0 51.491	$0 62.49682	....	$840 19
	Brunswick	630	925	1,973 58	13,860 60	15,834 18	88.384	53.382	66.11	....	855 39
	Mariposa	155	995	787 06	4,757 37	5,544 43	82.6867	40.2	55.65	$560 75	....
	C. Land's	839	905	5,969 47	16,750 22	22,719 69	78.647	61.02323	67.969471	....	4,237 65
	Summit	750	1	3,365 40	17,917 94	21,283 34	86.28813	56.19078	67.47836	....	1,803 69
October	C. Land's	1,003	555	1,869 91	31,203 24	33,073 15	94.7114	52.336	67.19663	....	774 25
	Summit	625	8	2,468 00	19,872 82	22,360 82	88.87844	48.98643	63.53832	779 83	....
	Brunswick	554	67	590 78	12,959 90	13,550 68	95.971804	48.70369	66.0658	1,769 13	....
	Rigley & Co	404	13	1,363 32	9,310 42	10,673 74	86.89778	49.014982	62.765612	91 21	....
November	Eureka No. 1	239	535	283 37	5,188 02	5,471 39	95.3153	45.83365	64.987	1,375 50	....
	Eureka No. 2	506	59	2,272 99	15,992 41	18,265 40	84.4001206	45.547817	60.3640826	1,063 01	....
	Summit	301	33	2,340 96	6,555 46	8,896 42	75.668352	48.704638	60.2853995	1,055 72	....
	C. Land's	1,042	47	7,202 18	30,856 04	38,058 22	80.373109	51.386743	62.055826	....	3,123 20
	Brunswick	606	235	472 92	14,425 31	14,898 23	96.6910947	44.584707	63.533419	2,213 45	....
	Rigley & Co	505	775	1,866 71	15,348 29	17,215 00	88.373109	46.540716	61.945255	1,298 56	....
December	Rigley & Co	123	14	....	2,969 41	2,722 73	1 06.828304	51.596703	72.676598	693 72	....
	Brunswick	496	435	2,699 68	12,651 19	15,350 87	80.714615	47.583226	59.884635	....	3,898 00
	C. Land's	1,118	22	7,625 22	27,309 73	34,934 95	77.20210135	52.113102	61.387848	....	3,696 39
	Winfield's	1,027	215	9,053 78	28,888 15	37,941 93	69.9479537	46.162214	54.7149983	967 07	....
1867. January	Winfield's	155	45	204 39	5,514 76	5,719 15	96.4652	47.3053	64.800205	809 96	....
	Brunswick	509	365	2,779 41	15,952 03	18,731 44	83.125	44.675	58.65373	78 28	....
	C. Land's	969	605	3,278 86	26,196 22	29,475 08	89.101	50.50167	64.4919239	472 16	....
	Union	112	76	736 11	3,593 13	4,329 24	74.401	31.694	46.7887	....	2,856 59
	Ophir	36	415	1,270 84	3,282 25	4,553 09	67.483	62.6007	64.105	....	677 17
February	Brunswick	353	7	6 01	6,115 87	6,121 88	99.91392	56.21858	70.78025	....	4,455 14
	C. Land's	970	1	1,885 95	18,309 77	20,195 72	90.52107	55.09584	66.713	....	376 29
	Eureka No. 1	202	455	29 45	3,484 90	3,514 35	99.15706	52.42763	67.51747	....	30 75
	Union	144	188	667 37	4,130 41	4,797 78	79.22616	38.41034	51.63	....	3,387 12
	Ophir	42	325	2,841 41	5,422 96	8,264 37	51.508547	54.15259	53.276076	....	2,964 68
	Bacon's	617	258	679 40	10,356 88	11,036 28	94.5025735	58.57339	70.459	....	704 92
	New York	240	13	34 71	4,177 53	4,212 24	99.2357	55.59754	69.76324	....	128 30
	Woodworth's	100	68	....	1,229 84	1,034 22	1 11.2104729	67.0438	81.1191138	....	560 41
Total	....	15,639	36	68,474 45	403,123 02	471,155 17	....	....	....	12,908 49	35,570 13

TABLE No. 3.

Table showing product of the Hale and Norcross silver mine during the year ending March, 1867.

Ore produced and delivered.	Tons.	Lbs.	Tons.	Lbs.	Quantity worked.			Assay values.			Yield.			Loss.		
					Period.	Tons.	Lbs.	Ore.	Per ton.	Amount.	Per ton.	Per cent.	Bullion.	Per ton.	Per cent.	Amount.
Produced from 335 and 700 ft. levels, 1st class.	78	1,486	......	......				Gold .. Silver .	$24 38.621617 40 79.672689	$306,582 90 512,895 43	$20 92.303715 21 29.853503	$0 85.7986208 52.20648	$263,043 90 267,764 65	$3 46.317902 19 49.819181	$0 14.2013792 47.79352	$43,539 00 245,130 78
Ordinary	28,727	1,650	28,806	1,130				Total.	65 18.294301	819,478 33	42 22.157218	64.773958	530,808 55	22 95.137083	35.226042	288,669 78
From 780 feet level, 1st class.	......	......	595	700	1st half year	12,571	1,950									
Total ore....	......	......	29,401	1,830				Gold .. Silver .	29 17.913112 51 63.865385	468,734 00 829,524 11	24 90.138237 26 41.90[illegible]85	85.339698 51.161342	400,016 18 424,395 67	4 27.774875 25 21.962535	14.660302 48.838658	68,717 82 405,128 44
Delivered to mills and reduced, 1st class.	78	1,480	......	......				Total.	80 81.778497	1,298,258 11	51 32.041087	63.501383	824,411 85	29 49.737410	36.498617	473,846 26
Ordinary	28,152	990	......	......												
Sold to mills, ordinary	404	1,510	28,635	1,980	2d half year	16,064	30	Gold .. Silver .	27 07.491167 46 87.875432	775,316 90 1,342,419 54	23 15.47811 24 17.09932	85.5211695 51.560656	663,060 08 692,160 32	3 92.013057 22 70.77611	14.4788305 48.439344	112,256 82 650,259 22
On hand......	......	......	765	1,850												
At mills	207	1,190	......	......												
In ore house...	558	660	765	1,850	Total....	28,635	1,980	Total.	73 95.366599	2,117,736 44	47 32.57743	63.9938178	1,355,220 40	26 62.78916	36.0061822	762,516 04

MEMORANDA.

Amount of reduction....................................	$434,770 68
Reclamations....................................	27,866 25
Net cost of reduction....................................	406,904 43
Per cent of reclamations....................................	.013156506
Net cost of reduction, per ton....................................	$14 00

Bullion product of the principal mines on the Comstock lode.

DURING THE YEAR 1867.

Company.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Novemb'r.	December.	Total.
Hale & Norcross	$102,571 72	$117,639 44	$79,144 02	$76,462 58	$150,826 68	$117,728 23	$133,906 17	$124,664 69	$71,950 24	$49,980 22	$57,655 81	$14,767 65	$1,007,297 45
Savage	250,000 00	270,000 00	150,000 00	337,000 00	40,000 00	370,493 96	375,000 00	359,644 37	360,295 29	352,066 00	310,681 00	193,919 50	3,737,100 12
Crown Point	140,000 00	129,850 00	64,541 58	63,971 00	82,000 00	77,550 00	120,043 00	54,291 85	49,000 00	42,071 23	52,299 30	47,100 00	920,717 96
Yellow Jacket	156,200 37	117,488 97	108,913 85	222,075 44	278,684 63	195,913 65	160,000 00	150,000 00	130,000 00	100,000 00	60,000 00	50,000 00	1,729,276 91
Gould & Curry	66,423 00	45,165 41	52,878 47	63,130 19	74,862 68	44,446 46	....	30,043 11	75,842 74	65,474 86	90,235 69	6,117 90	614,620 51
Chollar-Potosi	80,000 00	100,000 00	86,000 00	245,094 06	334,289 17	345,000 00	311,681 17	350,000 00	252,000 00	253,866 89	164,976 67	145,977 46	2,668,885 36
Empire M. & M. Co.	38,153 00	26,787 00	23,081 00	22,884 66	21,933 00	21,500 00	26,312 32	22,333 80	18,689 40	20,571 43	18,757 46	17,604 08	278,607 17
Imperial	115,948 67	116,200 00	90,431 96	95,162 91	94,000 00	107,000 00	99,627 54	89,280 00	97,980 00	68,897 94	63,395 48	68,571 00	1,106,495 50
Confidence	24,006 10	11,411 86	8,052 71	18,202 78	12,000 00	14,000 00	16,527 52	12,304 17	11,310 11	13,547 71	686 50	....	142,049 46
Ophir, (aggregate)	....	....	....	....	....	....	....	....	....	....	....	....	4,108 00
Kentuck	43,674 71	70,095 42	58,572 85	108,953 53	132,333 88	130,255 51	125,767 31	104,215 35	101,000 00	102,326 65	65,250 16	98,296 57	1,140,741 94
Gold Hill Q. M. & M. Co.	5,400 00	9,600 00	7,300 00	10,000 00	10,866 62	12,500 00	10,250 57	9,771 52	3,259 04	10,995 79	12,182 26	4,273 62	106,399 42 192,318 17
Overman, (agg'ate)	....	....	....	....	....	....	....	....	....	....	....	....	
Total	1,022,377 57	1,014,238 10	728,916 44	1,262,937 09	1,599,796 66	1,436,387 81	1,379,115 60	1,306,548 86	1,171,326 82	1,079,798 72	894,120 35	646,627 78	13,738,617 97

DURING THE YEAR 1866.

Company.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Hale & Norcross	....	$51,546 03	$64,059 33	$69,027 18	$55,942 46	$104,247 33	$125,073 00	$119,447 38	$153,666 63	$152,363 74	$167,034 89	$131,135 41	$1,186,543 38
Savage	$140,000 00	150,000 00	110,000 00	66,553 70	115,000 00	130,000 00	140,000 00	162,478 00	145,000 00	210,000 00	231,000 00	214,847 39	1,814,879 09
Crown Point	52,327 14	155,461 63	148,532 35	115,102 11	110,514 82	109,601 05	36,557 00	80,451 10	116,573 76	111,150 17	91,326 00	184,854 00	1,312,471 13
Yellow Jacket	111,794 13	85,000 00	96,519 65	84,827 28	130,366 24	292,274 00	281,706 00	379,699 92	292,566 78	180,288 67	202,090 27	160,000 00	2,297,132 94
Gould & Curry	133,153 95	152,964 76	174,096 46	142,472 28	150,804 91	146,640 49	125,000 00	134,395 23	117,821 35	114,321 67	124,683 61	108,427 00	1,624,781 01
Chollar-Potosi	43,200 00	59,745 00	85,950 00	87,338 00	90,359 00	74,862 00	71,641 00	65,682 00	50,367 00	58,962 00	60,645 00	100,000 00	848,751 00
Empire M. & M. Co.	38,191 82	36,000 00	27,697 00	29,542 49	34,363 04	34,482 75	28,440 76	31,520 25	41,813 15	42,000 00	45,000 00	33,240 12	422,291 38
Imperial	81,891 21	74,823 60	48,223 90	91,533 61	67,755 89	62,240 90	65,408 16	75,840 52	78,459 87	99,476 87	83,687 17	81,045 67	910,387 37
Confidence	19,474 12	10,141 19	12,474 01	17,624 09	15,869 42	20,869 47	46,196 74	29,696 58	37,059 56	41,563 72	27,975 69	25,987 12	304,931 71
Ophir, (aggregate)	51,523 04	27,478 51	49,604 45	84,340 81	81,593 57	25,665 89	19,582 60	27,684 56	20,683 22	22,586 24	6,729 19	....	417,472 08
Kentuck	....	....	....	....	....	....	....	....	....	....	....	....	571,506 79
Gold Hill Q. M. & M. Co.	....	....	....	....	....	....	....	....	....	....	....	....	....
Overman, (agg'ate)	....	....	....	....	....	....	....	....	....	....	....	....	27,953 00
Total	671,555 41	803,160 72	817,177 15	781,361 55	652,568 65	1,000,883 88	939,605 26	1,106,895 54	1,054,011 32	1,032,713 08	1,040 171 82	1,039,536 71	11,738,100 88

Bullion Product of the Comstock Lode.—The foregoing tables, from the Commercial Herald and Market Review, show the bullion product of the leading claims on the Comstock lode during the year 1867, as compared with 1866. The bullion product of the Yellow Jacket claim has been estimated for the last six months of 1867. The total product of the Comstock lode for the year ending December 31, 1867, is estimated by the most reliable authorities at $17,500,000. It is estimated that other districts in Nevada have yielded during the same period $2,500,000, making the total product of Nevada for the calendar year 1867, $20,000,000. The average percentage of gold and silver is shown in table 2, on the workings of the Hale and Norcross, being about 66 per cent. silver, and 34 per cent. gold. In the outside districts the proportion of gold is considerably less.

Assay Offices, &c.—There are four assay offices in Virginia and three in Gold Hill; some few of the mining companies assay their own bullion.

The amalgam is usually retorted at the mill and delivered to the assayer in the form of "crude bullion." After melting and refining it is assayed by the ordinary process of cupellation with lead, the accuracy of these assays being checked from time to time by the humid method.

The charge on bullion for transportation to San Francisco is one per cent., and on coin from San Francisco to Virginia one and one-eighth per cent., the latter being somewhat the highest, to cover the extra risks of loss and robbery.

STAGE ROUTES CENTRING AT OR PASSING THROUGH VIRGINIA CITY.

Route No. 1. *Virginia to Sacramento, via the Central Pacific Railroad,* with which it connects at Cisco depot. Two coaches daily each way. Fare, including railroad charges, from Virginia to Sacramento, $20; from Sacramento to Virginia, $25. This route crosses the Sierra by the Donner Lake Pass, the one selected by the C. P. R. R. The fall of snow during the winter is very heavy, and sleighs run from the terminus of the railroad to within 30 miles of Virginia. During the winter of 1866 and 1867 they ran for a short time into Virginia without changing.

Route No. 2. *Virginia to Sacramento, via Placerville and the Sacramento Valley railroad,* passing through Gold Hill, Silver City, Empire, Carson, and Genoa, connecting with the railroad at Shingle Springs. One coach daily each way. This route crosses the Sierras at the south end of Lake Tahoe. Snow on the summits of the mountains heavy. During the severest portion of the winter sleighs run from the summit nearly down to Carson valley. Before the construction of the Central Pacific railroad, nearly the entire freighting business between California and Nevada passed over this route. At the present time the Donner Lake road takes probably three-fourths, and will gradually secure the balance as the railroad approaches Virginia.

Route No. 3. *Overland route, from the Atlantic to the Pacific States,* passes through Virginia, one coach arriving and departing daily. Passengers complete the journey to Sacramento by either of the two previously mentioned routes. Fare to Austin from Virginia, about $15; to Salt Lake, $70; to the eastern railroad terminus, $100.

Route No. 4. *Virginia to Carson,* passing through Gold Hill, Silver City, and Empire, one coach each way daily.

Route No. 5. *Virginia to Dayton,* passing through Gold Hil and Silver City, one coach each way daily.

Route No. 6. *Virginia to Washoe and Ophir,* one coach each way daily.

Route No. 7. *Virginia to Idaho Territory,* passing through the Humboldt county settlements, one coach each way every other day. This line connects with the stages on route No. 1, at Hunter's crossing of the Truckee river, about 24 miles from Virginia.

ROUTE No. 8. *Fast freight, via Donner Lake and the C. P. R. R.*, one coach each way daily. Brings perishable freight to Nevada, carrying passengers only from Nevada to California, the amount of return freight being small.

ROUTE No. 9. *Fast freight, via Placerville and the Sacramento Valley railroad*, details the same as route No. 8.

ROUTE No. 10. *Fast freight to Belmont, in Central Nevada, via Austin*, one coach each way weekly. Carries freight and passengers both ways.

ROUTE No. 11. *Fast freight to Belmont*, one coach twice a week each way, carrying passengers and freight.

STAGE LINES CENTRING AT CARSON CITY.

ROUTE No. 1. *Carson to Dayton, via Empire*, one coach each way daily.

ROUTE No. 2. *Carson to Washoe, via Franktown and Ophir*, one coach each way daily.

ROUTE No. 3. *Carson to Aurora, via Genoa and Wellington's station*, one coach each way every other day. The mines at Pinegrove lie a few miles to the east of Wellington's. At Genoa this route connects with stages for Silver mountain and Markleeville, and at Aurora with stages for Blind Springs, Fort Independence, Kearsarge, and Owen's River valley.

The majority of these routes have been established for several years, and, as will be seen by the following table of postal routes, usually receive government aid, in the form of subsidies for carrying the United States mails. But few of them, especially those operating between distant settlements and through thinly settled countries, could exist without such assistance. Though suffering less severely from Indian depredations on this side of the Rocky mountains than on the eastern slope, these lines of travel, in some instances, absolutely require the presence of soldiers to make them safe modes of communication.

SECTION XVIII.

VIRGINIA AND ADJACENT DISTRICTS—FACILITIES FOR OBTAINING FUEL.

COAL.—No coal deposits which are likely to prove of permanent value have been found in the neighborhood of Virginia. Considerable prospecting has been done in the neighborhood of El Dorado cañon, a few miles from Dayton, where inferior lignite is found associated with triassic (?) limestones and shales, and at Crystal Peak, on the Truckee river, near the California State line, where lustrous black lignite is found in small quantities, in recent geological deposits. In the Palmyra mountains, a few miles from Como, a small vein of lignite is also found, but none of these localities can be relied upon for a supply sufficient to warrant an outlay of capital. Many other points have been located as coal lands, without any foundation whatever, the deceptive appearance of some metamorphic or igneous rocks having misled persons ignorant of geological formations into costly and useless expenditure of time and money.*

The entire district is dependent on wood for fuel. When the mines on the Comstock lode were first discovered, the surrounding mountains were covered with a scanty growth of scrubby pines, (known as the piñon or pinenut,) and a variety of juniper, generally called cedar. This supply has been entirely exhausted, the nearest remaining timber of these kinds coming to the market from the mountains east and south of Dayton, and north of Virginia, both localities about 12 miles distant from the place of consumption. Even at these points the amount easily accessible is rapidly diminishing. The rugged character of the mountains compels the lumbermen to pack the wood on mules, frequently two or three miles to places which are accessible to wagons. This and the distance from market make the price high, ranging from $14 to $16 per cord. The piñon is considered the most valuable firewood, being a hard, resinous, fine-grained variety, growing from 10 to 30 feet in height, and commands about $2 per cord more than the cedar. The whole district will ere long be entirely dependent on the practically inexhaustible forests of the Sierra Nevadas. Even now large quantities of firewood are brought from this source, though the fuel is considered inferior to the piñon. There are many mills working ore from the Comstock mines, located at the foot of the Sierras, and the teams hauling ore to these points bring return loads of firewood or lumber. Large quantities are floated down the Carson river yearly, a distance of 60 to 100 hundred miles from the forests at the head waters of the river to Empire City, in Eagle valley, and are shipped from that point to the mines and mills. The vicinity of Carson, Washoe valley and Galena also yield an abundant supply, but a wagon freight of 12 to 18 miles keeps the price at about the figures mentioned.

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* See article on coal deposits of Nevada, section 2, page 312.

CONSUMPTION OF FIREWOOD AND LUMBER.—The following table shows approximately the daily consumption of firewood in the district:

	Cords.
By hoisting works on mines	70
By mills crushing ores	378
For domestic use	120
Total	568

The average cost of this firewood will be about $10 per cord or $5,680 per day, giving a yearly total of over $2,000,000. Of this sum at least 60 per cent. is paid for hauling to the place of consumption.

The consumption of lumber and mining timbers in the district will reach somewhere near 25,000,000 feet, (board measure,) of which about 17,900,000 feet are used in and around the mines on the Comstock lode. The total annual value of this branch of business will not fall far short of $800,000 per annum.

OTHER MINERAL DEPOSITS.—The mining district under consideration may be called exclusively a silver region, its other mineral deposits being relatively of small value.

GOLD occurs in small quantities in many of the ravines along the foot hills of the Sierras, and Gold cañon was worked as a placer mine before the discovery of silver; but both of these operations have been discontinued for some years.

COPPER ORES are found in many localities, both east and west of Carson, but the difficulty of making copper mining remunerative in Nevada, with the existing high rates of labor, transportation, and supplies have prevented their development.

IRON ORES are abundant in the mountains southwest of American Flat, and about four miles south of Virginia, but they are unfavorably situated for working, and not likely to be of value.

LEAD ORES containing a considerable percentage of silver occur frequently in the neighborhood of Galena, in Washoe county. The mines have been opened to some extent, passing into the hands of several different parties, who have failed to work them profitably, though admirably situated as regards both water power for concentration and fuel for smelting. The galena is associated with considerable quantities of mispickel, which renders careful sorting essential to the production of good marketable lead, but the manner of the association is such that no difficulty need arise on this account.

PLUMBAGO of inferior quality is found extensively in the mountains east of the Carson river, a few miles from Empire, but has never been utilized. It also occurs between Virginia and Washoe, in the Washoe mountains, and at one time was used in the manufacture of crucibles.

SULPHUR occurs at the Steamboat Springs, condensed in the earth from the rising vapors, but not in any large quantity.

Limestone of fine quality is plenty in the mountains east and south of Virginia.

Number of Mining Locations Claimed and Opened.—The number of mining claims recorded on the books of the mining recorders of Virginia and Gold Hill does not fall far short of 5,000. If to these are added other claims throughout the district under consideration, the number will not fall far short of 8,000. When we compare this number with the claims on which work is being done at the present time, (probably not more than 50) we begin to realize the character of the wild mining fever which raged here from 1860 to 1863. It must not be supposed, however, that all claims at present lying untouched are worthless. Many of them developed ore, but too low in quality to pay a profit at the time they were abandoned. Still all the claims which may at any time in the future become valuable will not exceed a few hundred, a vast proportion of the 8,000 locations having no foundation whatever, and many of which could scarcely be pointed out even by the locators themselves.

COST OF MATERIALS.

The following table may be taken as a fair illustration. The few articles used in the mines not occurring in this table are added at the end, the average price being derived from the same source:

Materials consumed at the Gould & Curry mill during the year ending November 30, 1866.

Articles.	Quantity.	Cost.	Average price.
Wood, cords	11,442	$168,830 00	$14 72
Lumber, feet	172,857	3,725 00	(per M) 42 40
Shingles	21,500	185 00	8 60
Charcoal, bushels	5,848	1,659 00	28
Iron, pounds	12,639	1,698 00	13½
Gas pipe, pounds	450	258 00	57⅓
Castings, pounds	395,099	33,880 00	8½
Rivets, nuts, &c., pounds	853	175 00	20
Steel, pounds	1,253	315 00	25
Copper, pounds	178	142 00	80
Babbit metal, pounds	262	190 00	46
Nails, pounds	3,832	417 00	11
Zinc, pounds	172	42 00	25
Turpentine, gallons	25	72 00	3 00
Belting, pounds	2,888	2,192 00	....
Packing, pounds	494	497 00	1 00
Rope, pounds	393	96 00	25
Hose, pounds	136	97 00	....
Sulphate of copper, pounds	87,353	17,388 00	20
Salt, pounds	345,668	10,943 00	3
Lard oil, gallons	1,360	2,487 00	1 83
Kerosene oil, gallons	985	1,615 00	1 64
Linseed oil, gallons	40	99 03	2 47
Quicksilver, flasks	675	35,013 00	51 89
Cut bolts, pounds	923	214 00	23
Screens, pounds	743	633 00	1 to .75
Candles, pounds	2,980	819 00	27½
Axes and handles	71	67 00	....
Picks	42	20 00	50
Shovels	239	231 00	1 39
Feed, sacks	487	2,067 00	....
Hay, bales	196	1,120 00	....
Axle grease	116	58 00	50
Copper rivets, pounds	280	280 00	1 00
Tallow, pounds	10,863	1,361 00	12½
Alcohol, gallons	15	60 00	4 00
Brooms	189	147 00	77
Oakum, pounds	136	46 00	32
Sledge handles	157	77 00	50
Lamp chimneys	531	174 00	32
Hoes	76	71 00	1 00
White and red lead	1,241	242 00	20
Blankets	43	347 00	8 00
Leather	575	246 00	42½
Stone coal	9,751	714 00	(per ton) ..150 00
Water	....	6,835 00	....
Sundries	....	3,833 00	....
Mining timbers	....	....	$28 to $30 per M feet.
Hay	....	....	$37 50 per ton.
Barley	....	....	4½ per pound.

Population of Towns.—In the absence of census tables it is extremely difficult to give accurate information on this head. The population of the different towns may be estimated at about the following figures, which will probably be found rather over than under the mark:

Virginia, Gold Hill and Silver City	12,000
Carson	1,000
Washoe	1,000
Dayton	1,000
Empire	500
The entire district under consideration	20,000

Of this number about 1,500 are employed directly in the mines, and about 1,200 in the various mills, the remainder, whether engaged in farming, lumbering or in trade, being more or less dependent on the mining interest for their support. Were it not for its mining attractions, the district would in all probability have remained the desert it was in 1859, before the discovery of the Comstock. Previous to that time it supported only a scanty population, who made a livelihood out of the annual emigration over the plains.

Price of Labor.—Miners receive from $3 50 to $4 per diem, and blacksmiths, carpenters, brakemen and engineers, from $5 to $8. Mill hands earn from $3 to $5, according to the responsibility of their positions.

Mode and Cost of Living.—The following list of prices current for articles of domestic consumption is taken from the daily papers:

Flour, per 100 pounds	$6 00 a $6 50	Salt, 3-pound sacks	$0 25
California bacon	25 a 27	Whiskey, Monongahela	5 00 a $6 00
California hams	28 a 30	Whiskey, Bourbon	4 00 a 6 00
Eastern bacon	20 a 25	Whiskey, quart bottles	1 25 a 1 50
Eastern hams	20 a 25	Coal oil, per gallon	1 20 a 1 50
Butter, ranch	42½ a 50	Eggs, per dozen	62½
Butter, eastern firkin	40 a 50	Eggs, per box 50 dozen	50
Green coffee, per pound, Rio	35	Mackerel, per kit	5 00
Green coffee, per pound, Java	40	Mackerel, per barrel	18 00 a 20 00
Coffee, Chartres, 1 lb. papers	50	Trout, Lake Tahoe	20 a 25
Cheese, new California, per lb	25 a 37½	Codfish, per pound	20 a 25
Candles, per pound	30 a 37½	Salmon, salt, per pound	20 a 25
Corn-meal, per pound	10	Salmon, smoked, per pound	20 a 25
Lard, California, per pound	25 a 30	Salmon, fresh, per pound	25 a 37½
Crushed sugar, per pound	19 a 25	Herrings, fresh, per pound	25
Brown sugar, per pound	16 a 20	Herrings, salt, per pound	25
Powdered sugar, per pound	25	Potatoes, per pound	2½ a 3
Golden sirup, per gallon	1 50 a 2 00	Potatoes, sweet, per pound	12½ a 16
Tea, black, Comet, per pound	1 12 a 1 35	Cabbage, per pound	7 a 8
Tea, green, Comet, per pound	1 25 a 1 50	Green peas, per pound	12½
Tea, Japanese, per pound	1 00 a 1 25	Asparagus, per pound	20 a 25
Plug tobacco	85 a 1 50	Onions, per pound	6 a 10
Salt, 10-pound sacks	75	Beets, per pound	4 a 5
Salt, 5-pound sacks	50	Turnips, per pound	4 a 5

Even in the towns a large proportion of the population board at restaurants or hotels, at rates varying from $8 to $12 per week. Many mills are so situated that they are compelled to keep a boarding-house for the men employed, in which case they are usually paid so much a month including their board. This system is the inevitable result of the unsettled disposition of much of our population, who, in spite of oft-repeated warnings, are yet ready to believe that every new mining camp discovered is better than the one in which they are located, and rush to it accordingly, in the hope of making the "big strike" which shall bring them wealth and comfort in a day, instead of winning them by the old well-tried rule of patient industry and perseverance. There are many signs, however, of improvement in this respect; but the number of those who have come to look upon Nevada as a permanent home are very few, indeed.

House servants receive from $30 to $40 a month. Many Chinamen are employed in this capacity at about the same wages.

The great majority of private residences in this district are built of wood.

Benefits of the Pacific Railroad and its Branches.—The Central Pacific railroad at the nearest point will be about 20 miles distant from Virginia. Even were there no railroad connection between the two points, we should yet feel the advantage of this great thoroughfare, in more rapid and certain communication with the seaboard, and in reduced rates of freight. But its benefits are likely to be largely increased by the construction of a line from Virginia to a point on the Truckee river, about 26 miles east of the State line. This line has been carefully surveyed, its chief features being enumerated in the following abstract:

Length of road from the Savage mine in Virginia to the Truckee river and Central Pacific railroad, 20 miles.

Total length of road, 22 miles.

Total elevation to be overcome, 1,996 feet.

Average grade per mile, 115$\frac{54}{100}$ feet.

Heaviest grade per mile, 180 feet.

Minimum curve, radius, 300 feet.

Percentage of straight line, 65.

Total estimated cost, including equipment, &c., $1,105,743.

Total estimated revenue per annum, $1,368,320.

Probable net profits, 60 per cent. of gross revenue.

This line follows a hillside grade along the Washoe mountains to a point 1½ miles north of Virginia, where it descends into Long valley, and follows the waters of that valley to the Truckee river. These flow through smooth valleys, occasionally interrupted by deep gorges bounded on either side by lofty precipitous bluffs of trachyte or basalt; but in all cases the bottom of the cañon is comparatively smooth, and wide enough to admit of the construction of a good road without being compelled to adopt a hillside grade, except in one instance, for about 1½ miles. Owing to these circumstances, a good road can be built for a very moderate outlay, though the route lies through very rough and broken mountains.

A preliminary reconnoissance of this route was made early this spring, and the detailed location has just been completed with very flattering prospects. The importance of the early completion of this road to the mining interest of this district is almost beyond calculation. Its effects will be felt in the reduced price of freight on general merchandise, in the reduced cost of firewood and lumber, and in the possibility of working ores at present valueless from their too poor quality.

At the present time about 30,000 tons of general merchandise are brought from California to Nevada annually for consumption in this district, at a cost for transportation of about $1,800,000. Through railroad communication with Sacramento will result in a saving of upwards of $900,000 per annum, of which about 10 per cent. or $90,000 may be credited to the Virginia and Truckee railroad.

The road will also make the pine forests of the Sierra Nevadas easily accessible from Virginia, and from this source both lumber and firewood can be supplied to Virginia and Gold Hill at a reduction of fully 35 per cent. on present rates. The following details of the probable business of the road are from the report of the chief engineer, J. E. James. The figures show the present actual consumption in the localities where the opening of railroad communication with the Truckee river and the Central Pacific railroad would affect their price:

> According to the estimate of parties likely to be well informed, firewood can be delivered at the Truckee terminus of the road at $3 or $3 50 per cord. They propose to cut this firewood in the Sierras and float it down the Truckee river. Logs are at present furnished to Eastman's saw-mill (only a few miles higher up the river) from this source, showing the plan to be feasible, and furnishing data on which to base an estimate. Supposing, however, that these estimates are too low, and that the price at the terminus is $5 per cord, your company can supply the entire demand of Virginia, Gold Hill and Silver City at $10 per cord. In Virginia and Gold Hill this would be $4 per cord less than ruling rates to large consumers,

and $6 or $7 less than is usually paid by private families, and would certainly control the entire business, shown by the accompanying tables to be as follows:

For mills as per schedule, daily	223	cords.
For mines as per schedule, daily	72	"
For domestic use	60	"
Total	355	"

The present price of timber and lumber for mining purposes ranges from $28 to $30 per 1,000 feet, board measure.

In the report of the county assessor to the surveyor general of the State, for 1866, the cost of delivering logs and manufacturing them into lumber at Russell & Crowe's mill, at Empire City, is given at $12 per 1,000 feet, which is probably not far from a correct estimate. These logs are floated down the Carson river a distance of from 60 to 100 miles, from the forests of Alpine county, California. Lumber can be manufactured on the Truckee at rates equally favorable, thus enabling your company to place it in the market at a price not exceeding $21 per 1,000 feet. The following condensed statement shows nearly the present annual consumption:

Required by mines	17,910,100	feet.
Required by mills	920,000	"
Required for other purposes	5,000,000	"
Total	23,830,100	"

We have then the following result per annum:

Saving on 127,800 cords of wood, at $5	$639,000
Saving on 23,800,000 feet lumber, at $7 per 1,000	166,600
Saving on 30,000 tons merchandise	90,000
	895,600

equal to $1 50 on every ton of ore raised from the mines.

We again quote from the report of the chief engineer:

> The facilities afforded by the Truckee river will doubtless create an immense business in the transportation of low-grade ores to that river for reduction by water-power. Competent judges estimate that rock yielding $12 per ton can be reduced with profit both to mine and mill by taking advantage of its capabilities. All persons at all familiar with our mines are aware of the vast amount of low-grade ores now standing in the Comstock mines. We believe that 1,000 tons of this class of ore would be extracted daily in a short period after the completion of the road, but allowing for the gradual growth of the traffic, have based our estimate on 500 tons daily for the first year of operations.

On a basis of 500 tons daily, there would be from this source alone an increase on the annual production of bullion as follows: 180,000 tons, averaging $15 per ton, $2,700,000 or, supposing the quantity to be increased to 1,000 tons, the amount would be $5,400,000.

This bullion can be secured to circulation in no other way.

Neither will the advantages cease at this point. The ability to work $15 ores to advantage will immediately enable many mines at present lying idle to resume operations, and very materially lessen the annual assessment list. Neither can it be doubted that the reduced cost of working will gradually cause the removal of other mills to the Truckee. If all the ores were worked at that point the saving to the community would amount to upwards of $1,000,000 per annum, equal to nearly seven per cent. on the gross yield per annum of the Comstock lode. The minimum cost of mining ores has probably been reached; we must, therefore, look to improvements in the mode and cost of reduction, as an offset to the increased expenditure necessary to deeper mining operations, if we would keep our net profits at their present position.

SECTION XIX.

THE SUTRO TUNNEL.

One of the most important enterprises connected with the mining interests of the Pacific coast is the proposed Sutro tunnel, briefly referred to in preliminary report.

The magnitude of the work, its bearing upon the future yield of the mines located upon the Comstock lode, and its probable influence in demonstrating the continuity of mineral lodes in depth, in other parts of our territory, where the conditions may be similar, have been set forth in various reports upon the subject.

The Mechanics' Institute of San Francisco, a body composed of highly intelligent men, some time since appointed a committee to make a report upon the proposed tunnel, as being a work beneficial to the mechanical interests of the coast. The following extracts are taken from the report, which is quite an elaborate document:

Yield of Bullion.—These mines have now a world-wide reputation; the yield of the precious metals from the Comstock lode far exceeds that of any other locality.

The annual produce for the past five years has been in round numbers as follows:

1862	$4,000,000
1863	12,000,000
1864	16,000,000
1865	15,000,000
1866	16,000,000
Total produce in five years	$63,000,000

The total annual production of silver in the world in 1854 is stated by Professor Whitney at $47,443,200. The bullion obtained from the Comstock lode in 1866 is, therefore, equal to more than one-third in value of all the silver produced in 1854. Mexico, in its most flourishing days, from 1795 to 1810, produced an annual average of $24,000,000 from several thousand mines. After 1810, when the revolution took place, the yield of the mines fell in some years to as low a figure as $4,500,000, but the average from 1810 to 1825 shows $10,000,000. At the present time the entire product of Mexico does not exceed that of the Comstock lode.

The celebrated mines of Potosi averaged about $4,000,000 per annum for 300 years; those on the Veta Madre (mother vein) of Guanajuato about $3,000,000 for an equal period, and the mines of the Real del Monte Company, on the Biscanya vein in Mexico, over $400,000 for the last 110 years, or a total of $44,000,000, a less amount than has been obtained from the Comstock lode in the last three years.

Profits of Mining.—The immense yield of bullion from the Comstock lode will lead one to suppose that the profits realized by the owners have been proportional to the yield, but this has not been the case.

It is true that the value of bullion obtained by some companies has greatly exceeded the current expenses, as, for example, the Gould and Curry; the net profits of which amount to over $3,000,000. But some other companies have expended large sums of money and realized little, and some nothing at all. We have no accurate figures for the earlier years, but comparing the dividends with the assessments levied, we find that the aggregate produce of the mines has been swallowed up by expenses. In 1865 the dividends paid amount to $1,900,000, and the assessments levied to $1,950,000, or $50,000 more than the dividends.

In 1866 the dividends paid were $1,794,400; the assessments levied, $1,232,380. Dividends over assessments, $562,020. In the first years of operations on the Comstock lode, the expenditures for machinery, which had to be transported from California across the Sierra Nevada mountains, for the erection of costly reduction works, and for other permanent improvements, together with the extravagant prices paid for reducing ores in a very imperfect manner, absorbed nearly the whole produce. Latterly, the only increase of expense has been in mining operations; as greater depths were reached a large amount of prospecting or dead work had to be done, and additions made to the pumping and hoisting machinery, almost counterbalancing the reduction in the cost of crushing the ore, of labor, and of freight, and we consequently find that the aggregate profits of the mines at the end of the last year bear but a small ratio to the production.

The cost of labor and of reducing ores will gradually diminish from year to year, and on the completion of the Central Pacific railroad from Sacramento to the valley of the Truckee river, which will certainly be effected in the year 1868, the price of transportation from San Francisco to the mines will not be more than one-third of the average rates heretofore paid. But we do not believe that any reduction of expenses on these items which can be made will be sufficient to meet the increased cost of working the mines, after a few years, when greater depths are attained, if the present system of pumping out the water, and of raising the ore and refuse through shafts to the surface, is continued.

In the late report of R. H. Stretch, esq., State mineralogist of Nevada, we find it stated that 47 steam engines are now in operation on the Comstock lode, which answer all the present requirements, but every addition to the depth demands additional power, correspondent augmentation of capital invested in machinery, and a larger annual demand for fuel. The little wood there was originally in the vicinity of Virginia City was long since exhausted; it has now to be obtained almost exclusively from the eastern slope of the Sierra Nevada mountains, and as the nearer timber is destroyed, it must be hauled a greater distance and at an increased price.

If we take into consideration the cost of machinery, of annual additions and repairs, and of consumption of fuel, wages of employés, delays caused by breaking of pumps, expense of explorations, obstacles in securing good ventilation and increase of heat with the depth, and the financial result of past years, we are forced to the conclusion that the mode now adopted of working these mines cannot long be prosecuted with profit to the owners.

The result of similar operations in other countries, as furnished by Humboldt, Ward, St. Clair Duport, and other writers, conveys an instructive lesson to persons interested in mining enterprises. These authorities agree that mining from the surface must always prove suicidal to the interests of the owners when the position of the mines will allow the construction of adits or tunnels, which will drain the water, ventilate the mines, and diminish the cost of removing the ore and valueless material.

Humboldt, in his "Assay Politique sur la Nouvelle Espagne," published in 1803, in reference to the Veta Madre of Guanajuato, a lode much resembling the Comstock, exclaims:

"It is, indeed, strange that mines of such richness have no tunnels for draining, when the neighboring ravines of Cata and Marfil and the plains of Tumascatio, which are below the level of the lowest works of the Valenciana mine, would seem to invite the miner to commence works which would serve for drainage, and at the same time afford facilities for transporting materials to the smelting and amalgamation works."

A gentleman of intelligence, whom Humboldt questioned in regard to this want of wisdom, replied "that the excavation of a general tunnel would be a work very expensive, and perhaps impossible, on account of the *want of union among the proprietors of the different mines.*"

The Valenciana Mine.—Upon this lode is located the celebrated Valenciana mine, which, according to Humboldt, was first opened by Obregon, a young Spaniard, who, without means, commenced prospecting on a part of the vein which up to that time had been unproductive.

After undergoing many privations, he at last struck an immense body of ore, from which alone was extracted, from the 1st of January, 1787, to the 11th of June, 1791, the sum of $14,764,492 of silver, out of 134,988 tons of ore. Señor Obregon, afterwards known as the Count of Valenciana, became the richest man in Mexico, and probably in the world, at that time. As greater depths were attained, the increase of expense became such that the mine ceased to yield a profit, and before the breaking out of the revolution in 1810, it was allowed to fill with earth and water. In 1825, this mine, together with many others, fell into the hands of a wealthy English company, who expended 21 months in draining it of water, but the expenses of mining and pumping were so great that after some years the lower works were again abandoned.

The English Real del Monte Company.—The most remarkable and disastrous experience made by any foreign company in Mexico has been that of the English Real del Monte Company.

They became, in the year 1823, the possessors of the Biscanya and several other veins, the former having been worked for many years, and having yielded large amounts of silver, prior to 1749. At that date an intelligent miner, named Bustamente, concluded to run an adit, or tunnel, in order to effect their drainage. He labored long and patiently, and was supplied with means by Don Pedro Terreros, who continued the work after the decease of Bustamente. In 1759 the vein was reached, after running a tunnel 9,000 feet in length, cutting the vein at a depth of 600 feet beneath the surface, and exposing to view an immense body of ore. Terreros, in the 12 succeeding years, drew from his mines a clear profit of $6,000,000; he obtained the title of Count of Regla by the munificence of his donations to the Court of Madrid; he presented Charles III with two ships of the line, (one of 112 guns, constructed at Havana of the most costly material,) and accommodated him besides with a loan of $1,000,000, no part of which has been repaid.

His successor, the second count, continued the working of the mines, but not with equal profit, for the upper portions of the vein being worked out, he was compelled to go below the adit, and the water encountered required 1,200 horses to pump it out, at an annual expenditure of $250,000. After struggling for many years, and after a depth of 324 feet under the adit had been reached, the work was abandoned, and the mine allowed to fill with water.

It was in this state when the English Real del Monte Company took possession; they expected, by substituting powerful steam machinery for the horse whims which had been employed by the Mexicans, to make the mines again profitable. The result, however, was very disastrous, for in the 24 years they held the mines the expenditures were $15,381,633; while the total yield was $10,481,475, showing a loss of nearly $5,000,000.

They first erected two steam engines of 36-inch cylinders each, which freed the mine from water to a depth of 324 feet under the adit; at this point another one was required and erected of 54-inch cylinder, by which the working was carried to 724 feet under the adit; but here again the engines were overpowered, and still another engine of 75-inch cylinder was erected.

Mr. John Buchan, the superintendent of the mine, in one of his reports, made in 1852, says:

"After the mine had reached a depth of 710 feet under the adit (1,310 feet below the surface) the difficulties of drainage had so increased, both from augmented quantity of water and the greater height to raise it to the point of discharge, that three powerful steam engines could barely stem the coming waters of the mine.

"With the increased difficulty of drainage, seeing three bunches of ore worked out, and a debt of $5,000,000 still outstanding, it is not surprising that the energy and perseverance of the English adventurers were at last exhausted.

"Had the company prosecuted a projected deeper drain tunnel, it would have secured the continued prosperity of the mines for many years to come. It will be remembered that the first Count of Regla distinguished himself and made the fortune of his family by driving the present adit; the second count reached down 324 feet below it, being the limit to which the mines could be worked with profit by horse power drainage. The English company, by the powerful aid of steam machinery, carried down the workings to 720 feet below the adit; but here we find another limit to profitable working, as the deeper excavations of the Biscanya vein are again abandoned to fill with water.

"A deeper adit, which had to be driven a distance of 13,500 feet, had been commenced by the second count. The English company unfortunately adopted the more speedy plan, as it was supposed, of employing steam engines, instead of the slower but surer plan of driving home the deep adit, which could have been done with the investment of but little more capital than that expended in applying steam engines, and would no doubt have given a very different turn to the fortune of that company."

Mr. W. P. Robertson thus relates the financial history of this company:

"The London Real del Monte Company commenced working on a magnificent scale; then, under the influence of a panic, suddenly deserted, in the most critical time, their judicious and indefatigable agent at the mine, and the result has been unmitigated ruin. The mania in London at the time (1823 to 1825) was so strong and so general that no expenditure was for a moment grudged. People thought they were laying out tens to receive back thousands, so they paid up their tens with surprising alacrity. The management in London of many of the new companies under the reaction was miserably bad, and in the end many of the shareholders were completely ruined and retired to cottages, there to abandon forever their 'Chateaux en Espagne.'

"In 1825, the late Mr. Kinder, the enthusiastic leader of the Real del Monte Company, was offered $8,000 for each of his 30 shares of $500 paid up in that concern; he refused to sell, that is, he would not take $240,000 for what had cost him $15,000. The reaction set in, and down went all shares. In 1845–'46, those of Real del Monte were to be had at $12 50 each; that is, Mr. Kinder's 30 shares, which in 1825 were worth $240,000, had gradually dwindled down to $375! The company was all but bankrupt; no more assessments were listened to; and the debts could not be paid with unsalable engines, though they kept up the steam, nor yet with stones, although silver was in them. The shares have since gone to *nil;* no one will have them fenced in, as they are with unknown responsibilities and debts. In vain did their new, active, intelligent, and enterprising, though prudent manager and agent, Mr. Buchan, write to the shareholders to take heart and not to throw away their property. They had been panic-stricken in the first instance, they had got sick of the business in the second, and in this last and most helpless fit, they entered into negotiations for the sale of the property to a Mexican company. A bargain was struck, and the perpetual lease of Real del Monte, with everything on it, passed from the hands of the Real del Monte bondholders for an old song. The entire sum paid was $130,000, for a business on which $7,000,000 had first and last been expended: and even of the mite to be recovered, three-fourths were not to go into the hands of the bondholders at all, but to be appropriated in Real del Monte itself in the liquidation of sums still due to the servants of the old company. What a winding up! Shares once worth $8,000 each, now not worth 30 cents! and the actual movable property on the estate, in houses, workshops, machinery, crushing establishment, timber, wood, iron implements, utensils, steam engines, horses, horned cattle, mules, and many valuable miscellaneous materials, must be worth altogether some millions of dollars. The house of Regla alone cost a million and a half, and now is valued at a million of dollars—all gone for $130,000.

"Thus did Real del Monte pass from the Counts of Regla in Mexico, and thus has it passed from the luckless shareholders in London—the first paying the penalty of personal extravagance, the other an equally severe one of wild speculation and injudicious management. It is now in wiser hands than theirs, and prosperity dawns again on this almost national establishment or colony."

This history of the Real del Monte mine teaches a valuable lesson, confirmed by the result of almost every similar enterprise in Mexico. They show that after a certain depth has been reached and no drain tunnels constructed, the mines have been abandoned and the proprietors ruined.

St. Clair Duport, who published a work on the mines of Mexico in 1843, gives a general sketch of mining operations, which is a perfect representation of recent experience in California and Nevada. He says:

"Opening a mine by accident, somebody discovers, guided by the croppings elevated above the soil, quartz containing some metal. He exposes some pieces to white heat, and if he discovers thereon globules, or pearls of silver, he takes up the claim. The discoverer now seeks partners with capital to work this claim, as generally the means of one man are not sufficient for such an enterprise. At first they generally seek to extract the ore by following down on the vein, and open a number of shafts along its course; but in the same ratio as these shafts increase in depth the water increases too; galleries and new shafts become necessary, and finally, as is generally the case when the largest portion of the yield has been expended in such operations, particularly in mines which are not extraordinarily rich in minerals, the work has to stop on account of bad air and abundance of water, the improvements being of no further use.

"The owners now look for new partners; if the vein presents probabilities of richness at a greater depth, persons can be found who, for a portion of the stock, generally for half, advance the necessary means, which is to be repaid out of the first yield of the mine.

"After the water has been removed, and the shafts and galleries are made, and really rich ore is found, then commences the good time of the mine. Arrived at a depth where silver generally is abundant, and when the expenses to bring the water and ore to the surface are not too great, mining is a good paying business; that is what is called in the miner's language '*la bonanza*.' This time is hoped for with ardent desire, not only by the owners of the mine and the miners employed, but also by the entire neighborhood. In this case labor, and all necessary articles for mining, are in demand, and well paid for; the money earned with ease is spent freely, and everybody in the whole mining region having any claims is full of hopes to strike it equally rich. The buildings for the reduction of ores are now erected, and very often in a style altogether too costly for their use. Next, underground works are constructed to facilitate the hoisting of ore and water. In case the mines in '*bonanza*' belong to private individuals, these works are executed on a substantial basis, with a view of usefulness for the future. But in most cases, when a mine is divided amongst a number of shareholders, they present such a diversity of ideas that they often cannot agree upon anything at all, except to extract the most money from their mine in the shortest time possible, without even looking ahead for a few months. For this reason we cannot find one single well-worked gallery in such mines. The richest ore is torn from the mine, and less rich ore remains untouched to be taken out when 'la bonanza' ceases. It is difficult to understand why in times of prosperity a small portion of the yield is not spent to make new developments.

ABANDONMENT OF THE MINE.—"The pay streak once traversed, and the increased depth rendering the price of extraction too considerable, the 'bonanza' ceases. The less rich ore left in the mine is now taken out, and one of the greatest expenses being the keeping down of the water, the lower qualities of ore are abandoned.

"The reserved middle class of ores will pay expenses to explore the mine for a while, but the time arrives when a day's work, or the value of a pound of ore, ceases to pay, and the mine is thereafter entirely abandoned."

The author of the above description of mining operations in Mexico, written 25 years ago, could not have given a more truthful account of operations in the Comstock lode had he spent the last six or seven years in Virginia City. Our mining companies have been pursuing exactly the same course, and have followed in the footsteps of their Mexican predecessors. Ruin of the owners and abandonment of the mines has been the result there; ruin and abandonment must follow upon the suicidal course pursued here.

MINING IN EUROPE.—If we turn to Europe, however, we find that mining is carried on with intelligence, economy, and with a view to permanency. In England but few mines are located at any considerable elevation above sea level, and deep drainage by adits is impossible. But each mine has its adit, however small its depth may be beneath the surface, and in stating the depth of shafts in England they are given from the adit downwards; what is above the adit is not counted at all.

The most remarkable work of this kind in Great Britain is the great adit in Cornwall, of which an English writer says:

"The advantages of working mines by adits are well shown at the United mines, near Redruth, where an adit has been driven, commencing only a few feet above the sea level, which, with its branches, has a length of from 30 to 40 miles, and a depth under the mines of from 180 to 420 feet. By means of this work a saving in the consumption of coal is effected amounting to 24,000 tons per annum. This magnificent undertaking was completed in 1768."

MINES IN GERMANY.—The mines in Germany present by far the finest field for studying mining operations reduced to a science. There mining schools and learned professors have for years prepared young men, who were to be placed in charge of mines, with a thorough knowledge of all the varied branches required of mining engineers. It is owing quite as much to intelligent management as to the low rates of wages that mines are profitably worked in Germany which would be considered valueless in California or Nevada. There we see the most complete systems of drainage and ventilation, and mines placed beyond the usual contingencies of such enterprises, yielding nearly uniform dividends, and regarded by capitalists as good security for investment.

THE FRIEBERG DISTRICT.—A few years since it was proposed to drain the Frieberg mining district by an adit-level of the extraordinary length of 24 miles, which would cut the vein at a mean depth of 2,000 feet. This plan was vigorously supported by Von Beust and other eminent mining engineers, and received the sanction of the Saxon government. This gigantic work has not yet been commenced, but a deep adit is now being driven, which will drain the mines 400 feet below the present deepest natural drainage, and will have a length of a little over eight miles. It is eight feet wide, nearly 10 feet high, and rises in the whole distance 12 feet 6 inches.

In the Harz district some mines have attained an immense depth. The mine of Andreasberg has a depth of 2,450 feet, being one of the deepest mines in the world: adits have been there for centuries, the largest of which was completed three years ago.

THE ERNST AUGUST TUNNEL.—We make the following condensed extract from a report made by Dr. Geissler concerning this great work, called the Ernst August tunnel, after the late King of Hanover:

"On the 22d of June, 1864, a drain tunnel was completed which may be called the greatest work of the kind ever executed. To explain its objects and importance it will be necessary to give the following details:

"The mines of the Harz were about to be abandoned, or, more properly speaking, about to be drowned out by water beyond redemption. In the course of time the explorations in those mines went deeper and deeper, until they reached a depth of 2,000 feet. While the higher situated galleries ceased to yield pay ore in sufficient quantity, the exceedingly rich ores discovered in the lowest levels could not be reached on account of great bodies of water, which pumps and engines could not master, and the lower levels had to be, for the time being, abandoned.

"There have been drain tunnels in the Harz for a long time, which were used as canals for the transportation of ores. Already at the commencement of the 16th century mechanical means to remove the water from the mines were insufficient, and drain tunnels were constructed at that early period. The first tunnel was commenced in 1525, another in 1548, one in 1551, and still another in 1573. By aid of these tunnels mining was continued in those districts for 200 years, but about the middle of the last century it became difficult again to master the water.

"In 1799 another deep tunnel—having a length, including galleries, of 57,000 feet, or nearly 11 miles—was completed. But this also, afterwards, was considered insufficient for future purposes, for notwithstanding additional engines might have been used for a while, their dimensions and cost in mines which had reached such an enormous depth would have been very great. And, after all, the surest and cheapest way for water to be removed is by its natural flow; the engines have enough to do in pumping the water up to the Ernst August tunnel, as that gives the deepest natural drainage which can ever be obtained.

DESCRIPTION OF TUNNEL.—"In 1850, after careful surveys and due consideration, the construction of the Ernst August Tunnel was resolved upon; it was to commence at Gittelde, a little town at the foot of the Harz mountains, and it was estimated that 22 years would be required for its completion, but it only took a little over half that time, for it was entirely completed in 12 years and 11 months. Nine shafts had been sunk, from which 18 galleries or drifts were run, and one from the mouth, so that the work progressed from 19 different points. The connections were made with such perfection that they could not be recognized after they were completed.

"This tunnel has a uniform fall of 5 $\frac{4}{10}$ inches to each 630 feet, or 1 in 1,400; its height is eight feet three inches; its width, five feet six inches, and its shape that of an egg. The water has a sufficient depth to allow the use of long flat-boats, for the transportation of ore. A part of the water-course is covered over, to be used as a sidewalk for the miners."

NECESSITY OF A TUNNEL TO THE COMSTOCK LODE.—We have thus far reviewed the results of mining experience where drain tunnels have not been, and where they have been constructed, and the conclusion your committee arrives at is, that a deep drain tunnel to the Comstock lode will not only greatly facilitate mining operations, but is an absolute necessity; the sooner it is constructed the more benefit will be derived therefrom, and without it nothing is more certain than the abandonment of those mines before the lapse of many years.

The necessity of the tunnel having been sufficiently demonstrated, it remains to show that the ore which will probably be obtained from these mines will justify the cost of construction.

The first question to be examined is, whether the ore in the Comstock lode extends to an unlimited depth. This question has been so ably handled by Baron Richthofen, an eminent geologist of the highest European reputation, that we content ourselves by giving some extracts from a letter written by him upon this subject, in February, 1865, and published in one of the pamphlets issued by the Sutro Tunnel Company. For a more detailed account of the geology of the Washoe country we refer to his able report, to be seen on the tables of this institute.

CONTINUITY OF THE COMSTOCK LODE.—The learned Baron says: "The value of a deep tunnel will, of course, chiefly depend upon the question whether these mines will ever be worked to considerable depth; that is, whether the Comstock vein will extend far down, and whether it will retain its metalliferous character in depth. Both questions will have to be decided from the study of the structure and nature of the Comstock vein, and from comparing the results with the observations at such mines in other countries which have already been worked to great depth. My experience on the Comstock vein is based on close and repeated examinations of nearly all the mines on its course. I believe I concur with almost everybody who has had equal experience about them, in the opinion that it is a true fissure vein, of extraordinary length, and extending downwards much further than any mining works will ever be able to be carried on. It would be too lengthy to enumerate the various reasons which lead most positively to this conclusion. It is now assumed almost universally as a fact, and the number of those who consider it as a gash vein, or a system of gash veins, is fast diminishing.

"As to the downward continuance of the ore-bearing character, every instance goes to show that the average yield in precious metals remains about the same at every depth. Some mines had accumulations of ore near the surface, (Ophir, Mexican, Gold Hill;) in others they commenced very near under the surface, (Gould and Curry, Potosi, Yellow Jacket, Belcher;) at others, again, considerable work had to be done before bodies of ore of any amount were struck, (Chollar, the southern part of Gold Hill, Uncle Sam, and others;) and some which had no ore heretofore, appear to have good prospects to find it soon. The fact that some rich bodies of ore, which were found near the surface, gave out at a depth of a few hundred feet, induced the common belief that the Comstock vein was becoming poorer in its lower parts. But the explorations of the last few months have entirely defeated this opinion. On the contrary, the enormous amount of bullion which is being produced by the mines at present may almost appear to prove that the vein is improving in depth. But this conclusion is probably equally fallacious, as it must be borne in mind that many mines have been developed at different levels and ore is being extracted from several of those. Hoisting works and the mode of extracting the ore have also been improved, and of course help to increase the daily produce. This average equality of the produce of the vein at different levels is not only true for the amount of ore extracted but also for its yield. The rich body of ore in the Ophir and Mexican mines forms the only exception to this rule, as none of equal average percentage in silver and gold has been found again. Even the relative proportion of gold and silver in the ore has not undergone any material change, though the bullion, on account of the more imperfect process of reduction, contained at first proportionally more gold than at present.

"There is no reason to doubt that the equality of average produce and yield throughout the entire length of the vein will continue downward to any depth; besides the very obvious theoretical conclusion that vast amounts of silver could not be carried into the fissure from the overlying or enclosing rocks, but naturally had to rise from unknown depths, through the channel of the fissure itself, to be deposited in it where the conditions for sublimation or precipitation were given in its open space; experience in other countries by no means shows of a regular decrease or increase in yield as of common occurrence, though either of them may happen. More commonly, the produce of true fissure veins in precious metals has been found to be about constant."

The Baron wrote the above over two years ago; the explorations made since that time in the Hale and Norcross and other mines, strongly confirm the views expressed by him.

Nearly all writers who have specially studied the question of the continuance of mineral veins in depth have arrived at the same conclusion. We will give an extract upon this subject from an eminent French writer, M. Burat. He says:

"In all countries where isolated veins are worked, a large number of them have been abandoned and taken up again; abandoned because accidents or barren streaks rendered the working burdensome, and afterwards taken up again, when they have, by the aid of capital, been made productive mines. The same veins have been declared to be rich or exhausted for these reasons at different times; exhausted always when the owners were discouraged, and rich after the execution of further works had pierced the barren places. These are the facts of which we will relate several examples, and by which we intend to prove that each reworking of a vein after an abandonment more or less long, bears witness of the continuity of mineral veins in depth."

Burat and other prominent writers recite numerous instances of this kind, but we cannot give place to them in this report.

THE SUTRO TUNNEL.

The proposed tunnel begins 3¼ miles below Dayton, between Corral and Webber cañons. The distance from the mouth of the tunnel to the Savage Works is a little over four miles, but as the Comstock lode dips to the east, it will be cut in 20,178 feet. It will pass through the different ledges in Silver Star and other districts nearly at right angles. Allowing a grade of one inch in 100 feet, or four and four-tenths feet per mile, it will be 1,922 feet below the floor of the Savage Works. The topography of the country is admirably adapted for sinking shafts, four of which are proposed to be put down. They will not only supply the tunnel with fresh air, but will greatly expedite work, as drifts can be run each way after reaching the grade of the tunnel. The distance of the first shaft from the mouth of the tunnel is 4,070 feet; depth, 443 feet; second shaft from first, 5,150 feet; depth, 980 feet; third shaft from second, 4,060 feet; depth, 1,436 feet; fourth shaft from third, 4,054 feet; depth, 1,360 feet; from fourth shaft to Comstock lode, 2,244 feet; depth, 1,942 feet. These are convenient distances for working and ventilation. The mouth is about one and a half mile from Carson river, and 150 feet above high-water mark. There is a gradual descent for about one-third of a mile, in which a fall of 100 feet is obtained, giving sufficient area for dumping and mill sites.

The vertical section of the tunnel through rock not requiring any support is a circle of 12 feet diameter, with offsets 3½ feet from the bottom, about one foot wide, which support the superstructure of the railroad track to be used for removing ore and *debris* from the mine. The space under the superstructure is for drawing the water from the lode. Where timber supports are required to sustain the adjacent rock, the top is level, and 10 feet wide, clear of the framing; height eight feet to the bottom of the timbers supporting the railroad, where it is 12 feet wide in the clear. Below this there is a triangular space, three feet seven inches in depth, forming the water way.

The estimates of the cost of construction have been very ably discussed in a lengthy report by R. G. Carlyle, esq., covering some 200 pages of manuscript, and illustrated by numerous well-executed diagrams. Mr. Carlyle has resided some years in Virginia City, when he was the engineer of the Gould and Curry Company, and appears to be thoroughly familiar with everything connected with mining in that country. The minuteness with which he goes into the details of the proposed work, the elaborate calculations into which he enters, and the scrupulous manner in which he weighs his conclusions, entitle his report to careful consideration.

It is impossible for us to give more than a condensed abstract of the results he has obtained. The basis of his calculations is the experience of himself and others in mining near Virginia City, and the statements of Baron Richthofen in regard to the character of the material encountered in the construction of the tunnel. The Baron says:

"The facilities of excavating the tunnel would depend mainly upon the quality of the rock through which it will pass. It is a remarkably fortunate incident that the route selected by Mr. Sutro not only gives the greatest depth, is the shortest, has the best facilities for working shafts, but promises also in this respect to be the most advantageous. The first 6,000 or 7,000 feet will be through trachyte and trachytic breccia, which in a broad semicircular belt of prominent hills, swing from Dayton by the Sugarloaf to Washoe valley. Trachytic breccia may easily be worked by the pick, yet is ordinarily solid and dry enough to require no timbering. An idea of its excellent qualities for tunnelling may be formed from the fact that in Hungary wine cellars hundreds of feet in length are with preference excavated in this kind of rock. The solid trachyte is an excellent blasting rock. Its superior qualities have caused its general use in Washoe for building material; it was as such applied in the construction of the solid masonry of Gould and Curry mill. With the use of the drilling machine of Mount Cenis, speedy work will be made in this rock. The next 2,500 feet will, to all probability, exhibit a great variety of rock, some of which will be rather hard. The following 10,000 feet to the cutting of the vein will most likely consist of the same material as is traversed by the numerous tunnels which lead at present to the Comstock vein. This rock (trachytic greenstone) would offer some obstacles if it were in an undecomposed state. But from the general nature of its decomposition, which evidently was performed from below by ascending steams and vapors during a time of volcanic action, we believe we are justified in the conclusion that it will be found for the entire length of 10,000 feet of the same rotten nature as in the shallow tunnels at present in existence, and it may have to be timbered the whole distance."

Mr. Carlyle speaks as follows in regard to his experience with the two principal kinds of rock to be encountered:

"While I was in the employ of the Gould and Curry as their chief engineer, we used solid trachyte for building purposes, taken from a quarry on the side of the Sugarloaf mountain. I had, therefore, considerable opportunity of learning the particular characteristics of the stone. It is not porous, but is very close in its nature, has very few seams, no grains or special tendency to fracture in any particular direction. It is rather soft, and, in consequence, is easily drilled to any desired shape. The rock drills well and blasts freely, as it does not seem to have much cohesion on account of its many component parts. The rock does not air-slack; on the contrary, it grows harder by exposure."

This rock is extensively used for building purposes; all the stone buildings in the town of Dayton are constructed of it.

His experience in working greenstone porphyry he gives as follows:

"This class of rock is traversed by several tunnels to the Comstock lode, all of which were easily worked, and they had to be supported by timber. The Gould and Curry lower tunnel is the only exception to this, as it passed through 1,400 feet of undecomposed rock, which was not difficult to work on account of its favorable stratification; powder was used but to a small extent, and this for the purpose only of shaking the mass. The remaining 800 feet to the lode had to be timbered, as the rock would not support itself. The whole length of this tunnel, 2,200 feet, was run from one working point in 486 working days, or 16 months; the work, however, was distributed over a period of two years, as it did not progress steadily. The average daily progress was nearly five feet."

Mr. Carlyle estimates that 10,535 lineal feet of tunnel will be through solid rock, and 9,643 through decomposed rock requiring timbering.

Shaft No. 1 is 7½ feet by 13½ feet, and shafts Nos. 2, 3, and 4 are 7½ feet by 14 feet, outside of planking. They are timbered and planked from top to bottom, and divided into two compartments—one for pumping out the water, and the other for raising the excavated material.

Preliminary tunnels are driven from the bottom of these shafts in both directions till they meet. These tunnels are in solid rock, five feet in width and seven feet high, the top being a semicircle. In rock requiring timbering they are of a box-shape, four feet wide on top, five feet on bottom, and six feet four inches inside of the timbering, with a channel below for drainage.

TIME REQUIRED TO FINISH TUNNEL.—"The time required to sink the different shafts on the Sutro tunnel, and make connections of the drifts from the same, I estimate as follows, on the basis that four feet can be sunk per day on the shafts, and five feet made on the drifts:

"Connection from drift No. 1 in 462 working days.

"Connection from drift No. 2 in 693 working days.

"Connection from drift No. 3 in 708 working days.

"Connection from drift No. 4 in 815 working days.

"Since all these shafts would be progressing at the same time, the connections from shafts Nos. 1, 2, and 3 will be made before those of No. 4, and the whole time, therefore, required to finish a preliminary tunnel to the Comstock lode would be 815 days.

"The enlargement of this preliminary tunnel will progress from the mouth from time to time as the connections are made, and will be completed up to a point midway between shafts three and four by the time the last connection is finished. From that point 4,618 feet would still remain to be enlarged, which would occupy 116 days. The total time, therefore, required to complete the Sutro tunnel to the Comstock lode would be 931 days, or two years, six months, and 21 days."

The committee would remark in regard to the removal of the rock for 4,618 feet, that estimating the sectional area at nine yards, the amount is only 13,854 cubic yards, on which, as the cut can be worked all along the top and at the two ends, sufficient number of men can be employed to remove it in the time indicated.

Mr. Carlyle then cites numerous instances of shafts sunk by different companies, and tunnels driven to the Comstock lode, which prove that his estimate of four feet per day in sinking shafts, and five feet in driving tunnels, whenever prosecuted with energy, is confirmed by experience, making due allowance for their size and other circumstances, which in some cases have retarded work.

Your committee are of the opinion that, with proper energy, a sufficiency of capital, and provided no extraordinary obstacles are encountered, the tunnel might be finished in the time stated, but it is so well known that delays are met with in works of this kind, from causes impossible to anticipate, that it is probable that an additional time of least one year may be occupied. It is safe to say that, making all due allowance for contingencies, the tunnel can be completed in from three and a half to four years.

SECTION XI.

EASTERN NEVADA.

The eastern Nevada mining region, as the term is used, is understood to include that part of Nevada constituting the counties of Lander, Nye, and Lincoln; being considerably more than half the State; or embracing an area of three and a half degrees of longitude and seven of latitude, if we include the portion of territory taken from Arizona and added to this State by an act of the 39th Congress; making an aggregate of about 60,000 square miles, or an area equal to the entire State of New York, with several of the lesser New England States added. This great region, at the beginning of the present decade, was almost entirely unknown to the world, as it was unoccupied and unexplored, save one or two routes travelled by the emigrant from the valley of the Mississippi to the Pacific coast. It had been crossed along the line of the Humboldt river, and upon the more direct route, part of which is now the road taken by the great overland mail. Frémont and other explorers had also crossed by different routes, but they had regarded it as a sterile waste, and without looking for minerals or what might give value to the country, sought only for routes or passes by which they could most expeditiously leave it. So little was learned from these explorations that until within a few years past the country had been marked upon the maps as an unexplored region, generally destitute of vegetation and water, and sparsely occupied by a homeless, wandering, and degraded race of Indians. The desolation and sterility, not only of this particular region, but of all the country lying between the Rocky mountains and the Sierra Nevada, had become so generally acknowledged, that the wish had been expressed that these ranges of mountains might come together, and this great region be obliterated from the surface of the earth. The general appearance of the country throughout the "great basin" indicates that a partial elimination has taken place, as, topographically it presents the appearance of having once been a vast plain, which being pressed by the two great mountain ranges bordering on the east and west, broke or wrinkled the surface into parallel ridges and valleys whose axial lines quite regularly extend north and south. These corrugations are a prominent characteristic of the country south of the Humboldt river, and north of the 36th parallel of latitude. A peculiar feature of this section is, that it has no outlet to the sea, but its streams, which, though generally small, are quite numerous, flow from the mountains to the valleys, sometimes for a considerable distance in the valleys, and then are lost in the sand. The mountains, which rise precipitously, are from a few hundred to 5,000 feet above the subjacent plain, and as the general elevation of the plains is about 5,000 feet above the sea, the most lofty peaks attain an altitude above tide-water of 10,000 feet. These hills and mountains are usually covered with scanty patches of pine, cedar, and mahogany trees, furnishing excellent fuel, but generally valueless for building material, although there are localities where there are groves of pine, from which a fair quality of lumber is manufactured. These hills and valleys, if forbidding in their general aspect, and apparently barren, produce a most excellent and nutricious species of bunch grass, and constitute a very superior grazing country; while in the many cañons of the mountains, and in all the large valleys, are tracts of land of an exceedingly productive character. The lands susceptible of profitable tillage amount in the aggregate to a considerable area, and are capable of furnishing most of the products of the farm grown in temperate climates. The grasses, grain, and vegetables are of good quality. Agriculture and manufactures can be conducted on a limited scale, and will be great assistants to the chief resource of the country—mining. The mineral-bearing veins of eastern Nevada were first made known in 1862, at the time when attention was called to the subject by the developments made upon the "Comstock ledge," and from which near $75,000,000 of silver have been taken. The history of this discovery says:

> Early in the month of May, 1862, William H. Talcott, an attaché of the stage station at Jacobs's Springs, a post on the transcontinental stage route, while hauling wood from the hillside, now within the limits of the city of Austin, discovered a vein of metal-bearing quartz, and carried a small quantity with him to the station. The rock proving to contain silver, the ledge was located as a mining claim, and named the Pony, as the discoverer had formerly been a rider of the pony express. On the 10th day of May, 1862, a mining district was formed, including an area 75 miles in length east and west, and 20 miles north and south, and named the Reese river mining district. A code of laws was adopted after the custom of miners, and William M. Talcott, the discoverer, elected recorder, and the claims already discovered were recorded.

The extent of the district east and west is nominally 75 miles, but really it only extends from the western base of the mountain to the summit, about three miles.

This was the inauguration of the Reese river mining region. Its name is derived from a small stream called Reese river, flowing from south to north through the valley which borders the western base of the mountains. The extreme length of Reese river is about 150 miles, when it empties into the Humboldt, but the water usually sinks and is lost before reaching the latter stream. The valley averages about five miles in width, and contains some good agricultural land. The mountain range in which the silver was found received the name of "Toiyabee," an Indian word, meaning a range of hills. This range is of about the same length as the river, and is from 5 to 15 miles broad through its base, and rises above the subjacent valley from 1,000 to 5,000 feet. It is geologically composed of primitive rocks, of which granite or gneiss and slate are the principal, with quartzite, limestone, serpentine, porphyry, and others as occasional varieties. In all are found veins of quartz-bearing gold, silver, copper, lead, antimony, and other metals. In its general character, appearance, and formation it resembles the numerous other ridges running parallel to it through the country, and from 10 to 30 miles distant from each other, separated by valleys generally containing a proportion of tolerable soil, yet unoccupied and irreclaimed.

The discovery of silver being made known, the news spread rapidly and the people flocked to the locality. Situated on the line of the overland stage and telegraph, it was convenient to reach. The site for a large town was surveyed, and Austin was built; now incorporated as a city, with its mayor and board of aldermen, city officers, police, a city hall, a daily newspaper, saloons and stores, a national bank, private banks and assay offices, costly churches, public and private schools, public halls and lecture rooms, comfortable private dwellings, gas-works for lighting the city, water-works and pipes supplying the houses, sewered streets, stages running in all directions, and the telegraph connecting it with all parts of the world—in fact, possessing the usual features of a city. Referring again to the history of Austin in the directory of the city, the writer says: "Centrally in the State of Nevada is the young and happy city of Austin. Should its locality be sought for on the map of America, it will be found where is usually marked the vacancy of the 'unexplored regions,' in latitude 30° 29′ 30″, and in longitude west from Washington 40° 4′, or 117° 5′ west from Greenwich, England, being almost precisely in the geographical centre of Nevada."

This centre is conveniently reached from the east or west, and without hardship or danger. The great trans-continental highway runs through it with a daily stage, mail, and express. Two other stages, running between Austin and the Pacific, carry passengers and freight at very low rates. By daily stage the journey from San Francisco to Austin is performed in four days, at the cost of $50. By the other stages the time is greater by one or more days; the cost is from $15 to $30. The road is good, and freight wagons bearing 10,000 to 15,000 pounds weight are taken over it. The distance to San Francisco is 473 miles, of which more than half is travelled by steamboat and railroad. From the east the traveller leaves the Missouri river by the cars of the Union Pacific railroad or its branches. After the present year (1867) the cars will quickly and easily bear him 600 miles westward over the great plains, and thence by stage 900 miles through Bridger Pass by Salt Lake to Austin, requiring about 10 days of travel. Great bodies of immigrants cross annually with their own conveyances, subsisting their animals upon the native grasses, or, as may be done at the present time, purchasing forage which is produced at the settlements along the road. This mode of travel greatly lessens the expense, but requires from 40 to 60 days for the journey.

The laws and customs of Nevada, which are recognized by the government of the United States, permit miners upon the discovery of metal-bearing lodes in an unoccupied locality to organize a mining district, designate its bounds, pass a code of laws regulating the location and tenure of mining property, and choose a recorder of locations. These districts are usually from 10 to 20 miles square, though governed by the physical features of the country and the contiguity of other districts.

REESE RIVER DISTRICT—HOW CLAIMS ARE ACQUIRED.—Reese River district, Lander county, was the first organized, and has given its name to the surrounding country. Its mineral belt comprises an area on the western slope of the Toiyabee mountains, about two miles in width and seven in length. The dimensions were formerly greater, but the area mentioned comprises what is now considered as the district. Upon organization a code of laws was adopted regulating the size and manner of location of mining claims. The law as first passed accorded to the locators of a vein the ground and all the mineral it contained for a width of 200 feet on each side of the vein located. In a few months large additions were made to the population, and the law was amended so as to restrict ownership to the lode or vein actually discovered and located, with the privilege of occupying the surface necessary for working the mine. The mining laws of other districts in eastern Nevada do not differ materially from those of Reese river. The laws of Congress acknowledge the validity of these rules and permit miners to go upon the public lands and take possession of the mines, promising no interference. These laws explain themselves. The ground is public and open to all the world. Any man can go upon it, and by finding a vein of gold, or silver, or any other ore can make it his own, and is assured and protected in his title. In no other country is such a privilege given. A country stored with wealth invites the people of all the earth to come and take possession and become independent land-owners and miners.

Within the limits of the district over 6,000 locations have been made, but this does not indicate the number of distinct silver-bearing veins known to exist. There are many hundreds of known value. These veins are in the granite rock, and are from six inches to three feet in thickness. They generally lie parallel to each other, with a strike northwest and southeast and a dip to the northeast. A movement of the rock has at some places been made, and these ledges are broken or have "faults," and the angle of their dip is not so great.

Mode of Working.—The veins are usually explored by means of an inclined shaft commencing where the ore appears at the surface, and following down with the dip of the ledge. When, after thus sinking a distance sufficient to render certain the existence and character of the vein, it is thought desirable to open it as a mine, and to work it conveniently, a perpendicular shaft is sunk at a point some distance from the outcrop, as the ground permits, calculating to pierce the vein at a depth of 100 feet or more beneath the surface. These shafts are of different dimensions, the best being about 5 by 15 feet. The cost of sinking such a shaft and securely timbering it is about $60 per foot of depth.

Description of Ores.—A belt of silver-bearing veins runs from Marshall cañon, in the southern part of the district, northerly to the Amador district, a distance of about six miles. This belt is about half a mile in width. In it are a great number of parallel veins similar in character and generally rich. The different localities are designated as follows, commencing at the south: Miguel cañon, Marshall's cañon, Union hill, Central hill, Lander hill, Emigrant cañon, Telegraph cañon, Yankee Blade, and New York ravine, the northern line of the district separating it from Amador. Each of these localities is locally known for its particular mines in the more advanced stages of development. Those of the district most systematically opened are the Great Eastern, Timoke, Oregon, North Star, Florida, Magnolia, Savage, Diana, Troy, Buel North Star, Providencia, Kaleseed, and some others on Lander hill, in the city of Austin, and within an area of a few hundred yards square. These are veins, the gangue being quartz, of 10 inches to two feet in width, of highly concentrated ore, easily and cheaply mined. On Central hill are the North River, Hubbard, Naiad Queen, Penobscot, and others, which are well developed and have produced a considerable amount of bullion. On Union hill are the Whitlatch Union, Camargo, Silver Chamber, and Tuscarora, from which bullion has been taken. At Yankee Blade and in the vicinity are the Confidence, Maggie, Ontario, Yankee Blade, Whitlatch Yankee Blade, Miami, Chase, Metacom, Midas, Green Emigrant, Vineyard, Vedder, and Sclavonia, most developed and of the best promise, while many others are located, partially developed, and regarded as valuable. A catalogue of the locations made in the district, or an opinion regarding them, would be useless; many have been abandoned after some slight developments. The general character of the ore throughout the district is the same in the same relative positions. At the surface, and to the depth of 50 to 70 feet, where water is found, the vein matter is loose and friable, has a dirty or earth-stained appearance, and the silver is found in the form of a chloride ore, presenting a dark or straw-colored appearance. When the water is reached the vein matter shows the white, clear quartz, and the ore, then usually an antimonial sulphuret, is quite black, and, contrasted with the white quartz, presents a beautiful appearance. Its value is readily ascertained by one experienced in observing it. The ore taken from below, where the water has long existed in the earth, often contains beautiful crystals of silver. From these mines are obtained specimens which adorn the cabinets of the mineralogists, the lovers of the beautiful and unique, and the curiosity hunter.

The limits of this report do not permit a full description of the varieties of ores, nor the discussion of the formations of the veins. It will suffice to notice the manner of their development, and to show their value. In the district, as has been said, are more than 6,000 locations of mines of 500 to 2,000 feet each. Probably 1,000 of these have been so far developed as to prove that they possess a value; but of this number only a few are at present mined. A description of a few of the most noted on Lander hill will give an insight into the character of all and an idea of the extent of operations to be undertaken in the future.

The North Star, belonging to the Manhattan Company, was located in 1862. In its first stages of development it was opened by an incline, which exposed chloride of silver ore, and was mined with some profit. At a greater depth the ore was a sulphuret. Subsequently a perpendicular shaft was sunk, piercing the vein at the depth of 200 feet, and with powerful steam hoisting machinery the mine is still worked with profit. The vein is encased in granite, is generally about 14 inches in width, and is mined without the aid of powder. In February last, of some hundreds of tons mined and reduced at the mill of the company, the average product was $240 per ton of 2,000 pounds. The workings of the quarter ending June 30 show 507 tons, and a product of $149 40 per ton. The ore found in this mine, as in all the others in the district when below the line of permanent water, is commonly denominated a sulphuret, although it comprises several varieties of ore containing sulphur.

The Oregon is a parallel vein within a few hundred feet of the North Star, belongs to the same company, is worked by the aid of the same machinery, and in all respects resembles it.

The Great Eastern is opened by a perpendicular shaft, and is advantageously worked. In one month, to the labor of 30 men it produced 137 tons of ore, which returned of bullion an average of $346 77 per ton, or an aggregate of $47,507 50. The vein is from 10 to 30 inches in thickness, averaging perhaps 18 inches. The gangue is a clear white quartz, and the ore, which constitutes a large percentage of the vein, is an antimonial sulphuret, or, as locally termed, a ruby silver, from its dark red or ruby color. The mine was first opened by an incline following the inclination of the ledge, which dipped at an angle of about 30° from a horizontal, to the depth of 250 feet, developing much good ore, although the vein was very narrow. For the better opening of the mine a perpendicular shaft was sunk at a distance of 400 feet northeast of the croppings, which pierced the ledge at a depth of 300 feet. At this depth it was found of greater size and value than in the incline. It is unfortunate that at the date of this report the workings should be in barren rock. A depth of 350 feet has been reached, and extensive explorations have been made without finding ore of the quality which heretofore made its workings so profitable. The mine is worked through the vertical shaft before spoken of, which is divided into compartments to create a current of air, that passes down one compartment and up another, affording excellent ventilation. At the greatest depth (350 feet) the temperature is 60° Fahrenheit.* The altitude of the surface is about 6,000 feet above the sea. The mine is easily drained, discharging 20,000 gallons daily. The water is raised in a bucket by a steam engine of 50-horse power, which also does the work of hoisting the ore and waste rock from the mine, which amounts to 60 tons per diem. The cost of transporting the ore to the mill and milling is as agreed upon. If the entire amount of bullion produced or the "clean-up" is returned, the charge is $65 per ton; but if the miller agrees to return 80 per centum of the assay value of the ore, the charge is $45 per ton.

THE FLORIDA vein presents many characteristics of the Great Eastern, is in size about the same, and furnishes the same quality of ore. It is owned by the New York and Austin Silver Mining Company, and is mined under the superintendence of Mr. Edwin A. Sherman, a skilful mining engineer. The claim is 800 feet in length, and is situated near the centre of the belt passing through Lander hill. Its strike follows the general direction of veins through the hill, being northwest and southeast, its dip being 29° from a horizontal plane. Its development under the present management commenced August 18, 1866. It is opened by an inclined shaft following the vein, and has now reached a depth of 350 feet. From this incline three levels are running; the first at a depth of 150 feet, which has extended to the northwest 65 feet, and above which for a width of 30 feet the ore is mined out. Through this mining the average width of the vein is 10 inches. The second level is 50 feet below the first, and between the two all the ore has been mined. This level extends to the southeast a distance of 230 feet, and the ore has been taken out for a width of 30 feet above the level along 100 feet of it. The average width of the vein through this working was eight inches. A third level is run at a depth of 300 feet, which has reached a length of about 30 feet on each side of the incline. Along this level the vein has a thickness of 16 inches. The amount of levels run in the past year aggregate 760 lineal feet, making 32,000 cubic feet of rock removed from the avenues alone in the development of the mine, and about 18,000 more have been removed in the excavations necessary in taking out the ore, making an aggregate of 50,000 cubic feet of country rock actually removed from the mine, or a small fraction over 4,000 tons. The number of tons of ore taken from the mine in this time is 317, 28 of which have not been worked. From the ore worked, 288 tons and 1,679 pounds, there has been produced $74,823 82, or an average of $259 per ton of 2,000 pounds. The actual cost of working this mine to produce the above sum has been $65,740 21, leaving a net profit of $9,083 61. The expenses include officers, rent, taxes, &c., &c. To the profits should be added the value of the levels run to be used in the further operations of mining, which, at a reasonable estimate, should be $15,000; also a property above ground on the mine worth $5,000 more. The above statement is for the 10 months ending June 30, 1867. Since then machinery has been erected for hoisting, of the value of $10,000, and about $5,000 worth of ore taken out and hauled to the mill ready for crushing; so that thus far it may be fairly stated that the mine has paid the expense of its development, including the cost of machinery, &c., with a value of not less than $30,000 above ground, and the value of work performed for future benefit.

THE SHERMAN SHAFT.—On the 7th day of February last was commenced the Sherman shaft by the superintendent of the Florida mine, in honor of whom it is named. This shaft it is designed to sink to the depth of 1,000 feet, and as much deeper as it shall be found practicable to go. Its dimensions are 5 by 15 feet; it is timbered or lined with plank three inches in thickness, and by the same character of planking is divided into three compartments. Up to July 28 a depth of 175 feet had been reached, all of which is substantially timbered. Water was reached at a depth of 145 feet. The cost of sinking the shaft to the present time has averaged $61 per foot, including all expenses.

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* At 1st of August the temperature at the surface is 82°.

The Burns Shaft is projected by the same engineer, is for the same company, and is of the same plan and dimensions, and is named in honor of B. J. Burns, local editor of the Daily Reese River Reveille. It is situated on the crest of Lander hill, as is the Sherman shaft; is, at its starting point, 150 feet lower, and about one-fourth of a mile northwest of the latter. It has reached a depth of 80 feet, (July 28,) and has cost about the same per foot as the Sherman shaft.

These two shafts are the enterprises of the New York and Austin Silver Mining Company, and are designed for working the Florida, Semanthe, Rubicon, Saratoga, and other ledges belonging to the company, and such other blind or non-cropping ledges as may be discovered in sinking; but more especially for the penetration of the basin which is supposed to lie below the crust in which the numerous and parallel fissure veins are found. To continue these shafts to a great depth, heavy and powerful steam machinery of not less than 200-horse power will be required on each, and deep levels must be run connecting the two shafts. The machinery for the Sherman shaft has already been contracted for, and will be placed on the mine by the 1st of October of the present year. These shafts are important and most promising enterprises, and, if carried out as designed, will prove the wealth of Lander hill at a great depth. It is expected they will be completed in about three years.

The Magnolia is a location upon the same vein as the Florida, joining that claim on the northwest, and of course in many respects it bears the same characteristics. The vein is explored to the depth of about 250 feet, and bodies of good ore have been developed. This mine is locally distinguished for the high grade of ore that has been taken from it near the surface. Its greater depths are but little developed.

The Timoke.—Lying between the Great Eastern and the mines of the Manhattan Company is the Timoke, a small mine, but one that has been profitably worked under the superintendence of W. F. Leon, for a company residing in Boston, Massachusetts. The vein is from one to two feet in thickness, and in general character is the same as the others of Lander hill.

Plymouth Silver Mining Company.—The Plymouth Silver Mining Company is organized under the laws of the State of New York. It owns the Kaleseed, Parent, Zimmerman, and Jacob mines on Lander hill, lying in close proximity to each other and parallel, so that they may be well opened and worked by one perpendicular shaft. Such a shaft is in course of construction under the superintendence of Charles C. Lane. It is the intention to sink this shaft 400 feet, 108 of which has already been reached, (August 1.) No very extensive mining has been done upon these veins, only sufficient to give proof of their value and to encourage thorough opening. A few tons of ore from the Kaleseed lode was lately reduced and showed a value for first-class ore of $1,763 02 per ton, and the second class a value of $280 53 per ton. This ore was taken from a depth of 25 feet from the surface. The veins are quite small, seldom exceeding a foot in width, but the high grade of ore which characterizes these and other veins of the neighborhood has made their working profitable.

The Savage and other Mines.—The Savage, Morgan and Muncy, Diana, Providencia, Whitlatch, Union, Troy, Buel North Star, and many others in the neighborhood, have been extensively mined and at times have been productive. A description of each, where all are so much alike, would be exceedingly tedious. It may be remarked that those mentioned, as well as others, are within an area of a few hundred yards square, and that in the district are several miles of area of equally good ground, judging from the slight developments made upon the surface, and where undoubtedly as good mines could be opened as those mentioned. In the great mining enterprises of Virginia and Gold Hill in western Nevada, where in the last six years near $70,000,000 have been taken from the mines, there exists but one grand lode, the Comstock, which is divided through its length into a great number of claims, or mines, many of which return largely to their owners, while some return nothing. This has been the most productive vein in the world. In the Reese River district such a gigantic lode has not been found, but there extends a belt some six miles in length and half a mile in width, in which are innumerable small veins, such as here described, of highly concentrated ore, easily and cheaply mined. From a few mines upon this belt there were produced in the last month $109,221 87. There appears to be room for many times the present mining operations, with the same proportion of production, yet the resulting figures are so great that one scarcely ventures to make the calculation. An increase based upon the full development of all the mines of known value would amount to several millions of dollars monthly, from an area not exceeding fifteen square miles, the utmost capacity of the district. Upon a close examination of the ground the conviction is irresistible that there will be a greatly increased production within a few years. A full development of the district awaits the coming of the railroad, with capital, labor, and cheap subsistence.*

THE MILLS.—An enumeration of the mills in eastern Nevada, and their capacity, would give a wrong impression and seem incongruous in calculating the production of bullion, without some explanation. It must be understood that it requires more to constitute a mill than a set of stamps placed in battery, with an engine to work them, and pans to amalgamate, or furnaces to roast the ore. The building requires to be well and substantially constructed; all its successive parts to be systematically arranged; the power full and sufficient; and then energetic, economical, and scientific management. Many mills have been built without due consideration as to what was required, and some upon experimental plans which were not successful. These have been failures, and now stand idle, and should not be counted in the list.

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*Mr. J. P. Kimble, in an interesting communication to the American Bureau of Mines, of New York, says:

"The interests of the Reese river district are rapidly advancing under the improved treatment of its ores of all varieties, and more especially the utilization of those of lower grade, which at first were generally discarded. Formerly only very rich ores would bear the cost of milling and amalgamating, so greatly was this augmented by the incomplete extraction of silver, as well as by their supply far below the capacity of the extensive mills, which therefore could not steadily be kept in operation. Dry crushing and roasting preparatory to amalgamation have effected something towards the utilization not only of the more refractory antimoniated ores, but also those of medium grade and the richer tailings. In the mills of Reese river the standard of yield is as high as from 80 to 85 per cent. of the absolute value of the ores in silver, attained at a cost which has gradually fallen from $75 to from $40 to $50 per ton. The mills of Storey county using Comstock ores produce not more than 65 per cent. of their value, though enabled to work ores yielding as low as $15. Thus there is entailed upon the Comstock lode an annual loss of $7,000,000; upwards of $9,000,000 this year, (1867.) The one thing needful above all in Nevada is the adoption of means, according to the varying circumstances and resources of different localities, to concentrate ores of low grade, and, what is practically the same, the tailings or residue obtained in the dressing of ores of better class. This is an object of far greater moment at present than the discovery of mining ground in addition to what is already far in excess of available capital to develop. The greater bulk of Reese river ores are at present valueless for want of cheap dressing and concentration. In the deposits of that district as well as in the Comstock lode, first-class ores in heavy bodies are of unfrequent occurrence. The average yield per ton of all Gould & Curry ores reduced was nearly three times as rich in 1863 ($80 07) as in 1866, ($28,) and in 1860 ($156 62) was nearly twice as rich as in 1863. That of other leading mines on the Comstock lode does not at present exceed $40 per ton, while in a majority of cases it falls below $30. The books of the assessor for Lander county show 46 mines, mainly in the Reese river district, to have produced more or less bullion during the quarter ending December 31, 1866. The largest production of ore was by the Savage Consolidated mine, being 451 tons of an average yield of $103 25. The Great Eastern gave 287 tons, averaging $217 94. Of these 44 mines, two, producing lightly, yielded about $400 per ton of ore; three between $300 and $400; five between $200 and $300; 18 between $100 and $200; 18 below $100."

The mills of all classes now standing, the power, stamps, and districts, are as follows:

Name of mill.	District.	Power.	No. of stamps.
Manhattan	Reese River	Steam	20
Boston	...do	..do	10
Silver Hill	...do	..do	5
California	...do	..do	10
Long Island	...do	..do	5
Keystone	...do	..do	20
Midas	...do	..do	15
Metacom	...do	..do	10
Ware	...do	..do	5
Butte	...do	..do	8
Empire and Silver State	...do	..do	10
Parrott	Big Creek	..do	16
Phelps	...do	Water	5
Pioneer	Union	Steam	10
Knickerbocker	...do	..do	20
Rigby	San Antonio	..do	4
Pioneer	...do	..do	10
Martin's	Silver Peak	..do	10
Stirling	Bunker Hill	Water	20
Murphy	Twin River	Steam	20
La Plata	North Twin River	..do	10
Buel's	Philadelphia	..do	10
Gould's	Hot Creek	..do	*10
Rutland	Reveille	..do	5
Social	Gold Cañon	..do	5
Hope	...do	..do	5
Pioneer	Pahranagat	..do	5
Valley	...do	..do	10
Crescent	...do	..do	5
Cortez	Cortez	..do	13
Total			311

* Light.

Other mills have been constructed and removed or dismantled, which have been mentioned in other reports but do not appear in this. The above are either in operation or in condition to be put in operation, although the arrangements of some are such that they are run at too great expense to be profitable, or cannot compete with others in doing custom work. The majority are standing still. Mills are in course of construction as follows: One of 20 stamps at Smoky Valley district; one of 10 at Hot Creek; one of 40 and one of 20 at Philadelphia; one of 20 at Pahranagat; one of 5 at Bunker Hill; one of 20 at Newark; one of 20 at Egan, (Gold cañon;) and others are in contemplation.

THE KEYSTONE MILL, at Austin, may be taken as a sample of its class, from its arrangement, construction, and cost. It was built in 1865, by Mr. A. L. Page, its chief owner and manager, with several additional buildings, as residence of superintendent, stables, blacksmith shop and store-house, all of brick, at a total cost of $91,800. The mill is divided into four rooms or divisions: 1st, boiler and engine room; 2d, battery room; 3d, furnace room; and 4th, amalgamating room. The first three occupy the front, and the last is in the rear of the battery room. Their dimensions are as follows: engine room, 45 feet deep by 25 front; battery room, 45 by 35; furnace room, 50 by 140; and the amalgamating room, 45 by 35; making a total frontage of 200 feet with a depth of 90 feet. The engine is of 60 horse-power. There are 20 stamps of 750 pounds each, drop eight inches and 78 times each minute. There are eight reverberatory furnaces with hearths 11 by 13 feet; 14 pans or tubs, five feet in diameter; six settlers, six feet in diameter; with retorts, smelting furnaces, &c. The total amount of freight hauled from California for this mill, as machinery, lumber, and material for building, was 140 tons, at a cost for freight of nine cents per pound from San Francisco. (The price is now six cents.) The cost of the machinery in San Francisco was $18,000, and the total cost, as stated, $91,800. It crushes dry, roasts and amalgamates, producing bars of bullion at a cost to the mill of $25 per ton. For custom work it charges $45 per ton and agrees to return 80 per cent. of the assayed value of the ore. Twenty tons of ore can be reduced in each 24 hours. Four cords of wood are used per day in making steam for the engine and for heating the pulp in the pans, and eight cords for the roasting furnaces. Wood usually costs $7 per cord. Salt, of which a considerable quantity is used in chloridizing the ore, is furnished from the large fields in different parts of the State, at from $30 to $40 per ton. About 200 pounds of quicksilver is used at each charge of a pan, but varying with the amount of silver in the ore. The quicksilver costs 60 to 75 cents per pound; about one per cent. of it is lost. The wages paid are, for amalgamator, $10 per day; first engineer, $8; second engineer, $6; fireman, $6; blacksmith, $7; carpenter, $6; pan attendants, roasters, and battery feeders, $4 each.

The expenses attending the production are: first, mining the ore, exceedingly variable; second, hauling to the mill; third, the State tax of 1½ per cent. upon ore after deducting $40 per ton; fourth, cost of milling, $45 per ton; fifth, internal revenue tax on bullion of ½ of one per cent.; melting and assaying one per cent., and transportation to San Francisco three and a half per cent., making a total tax of six and a half per cent., besides the cost of mining, hauling, and milling. To these are to be added the income tax, the many stamps used on receipts, certificates, checks, &c., incident to the constant handling and exchange of valuable property, the customs and internal revenue tax levied on machinery, raw and manufactured material, of which the miner is a destructive consumer. Thus it will be observed how disproportionate are the taxes imposed upon the miner, compared to other occupations; the tax being both upon what he produces and what he consumes, while he is without the protection given to others. A tax on iron may be added by the miner to the price of the iron, but a tax on silver is never returned, and the silver miner pays the two taxes. All taxes are paid in currency, but estimates are also made in currency when taxes are so paid. The business throughout the State, with the exception of the district of Pahranagat, is carried on in coin, estimated at par, and all expressions of money used in this report mean in coin, unless currency is expressly mentioned.

OFFICIAL RETURNS.—A law of the State of Nevada levying a tax upon the products of mines compels the county assessor of each county to collect from the mills and mines quarterly statements of the amount of ore mined and reduced, and the average production per ton for the quarter of bullion obtained. This statement is given under oath, and the amounts produced are estimated in coin. The assay value of the ore is from 20 to 40 per cent. higher than the amounts given in these reports, these being only the amounts obtained from the working, a portion always being lost. The reports are for Lander county, but large quantities of ore are brought to Austin from districts in Nye county, and are included in the returns. These, in the returns for the quarter ending September 30, 1866, are marked thus: Philadelphia,* Danville,† and Northumberland.‡ The returns for one year furnished, taken from the assessor's report, as published, in the Daily Reese River Reveille.

Quarter ending September 30, 1866.

Name of mine.	Tons.	Pounds.	Average per ton.
Great Eastern	412	639	$176 82
Fortuna	23	....	85 71
North River	39	536	217 56
Troy	2	1,000	83 82
Diamond	1	402	132 57
Blind Ledge	2	1,968	128 64
Semanthe	2	774	276 97
Othello	5	1,135	36 53
Idora	16	1,237	212 62
Highbridge *	17	....	195 36
Eastern Oregon	1	....	86 46
Foster	26	1,212	48 47
La Plata	50	892	71 60
Chase and Zent	4	1,000	362 04
Canada	6	1,500	132 90
El Dorado*	2	568	294 58
Magnolia	4	1,171	259 93
Washington	4	88	187 45
Vanderbilt†	2	1,670	115 46
Morgan & Muncey	17	631	107 75
Diana	17	503	180 40
Richey & Hussey‡	7	612	201 75
Detroit‡	4	1,800	116 18
Camargo	39	....	90 77
Timoke	28	253	167 92
Green & Oder*	1	600	178 43
Dover	2	450	161 64
Isabella	19	503	40 18
Harding & Dickman	1	1,233	87 19
Providential	79	1,000	39 04
Cortez Giant	227	....	66 07
Transylvania*	19	330	161 00
Folsom	5	1,019	166 00
Savage Consolidated, No. 1	160	....	156 83
Savage Consolidated, No. 2	230	....	74 06

Quarter ending December 31, 1866.

Name of mine.	Tons.	Pounds.	Average per ton.
Amsterdam	1	250	$168 75
Buel North Star	4	1,929	336 57
Camargo	12	973	116 57
Chase	4	1,438	405 10
Diana	143	1,909	91 18
Enterprise (White Pine district)	1	....	111 53
East Oregon	4	779	137 65
Empire State	7	619	99 22
Ensign	1	667	66 25
Fortuneteller	4	416	177 28
Florida	13	1,900	275 60
Fenian Star	7	1,359	54 24
Fortuna	1	1,520	30 33
Parrel	3	1,453	71 12
Great Eastern	287	....	217 94
Idora	22	1,695	220 42
J. R. Murphy	1	100	251 18
Joseph Cole	1	1,350	27 85
Jacob Bradley	1	....	116 80
Keystone	2	350	194 66
Kilbeck	1	....	197 27
Zaideo	1	728	100 61
Lodi	7	1,019	32 54
Livermore	3	300	157 79
Mount Tennbo Company (Cortez)	....	....	....
Morgan & Muncey	4	626	25 69
Magnolia	6	1,671	238 23
Metacom	26	....	100 99
Manhattan Company	69	288	83 90
May & Davis	2	430	136 80
North River	13	1,924	56 03
Owen & Perkins	3	1,700	46 16
Providential	64	844	54 91
Pinney, Rev	6	600	51 73

Quarter ending December 31, 1866—Continued.

Name of mine.	Tons.	Pounds.	Average per ton.
Patten	2	824	$200 43
Remington	6	1,500	49 63
Savage Consolidated	451	....	103 25
Silver Queen	14	1,913	78 28
Surprise	1	....	171 66
Semanthe	2	150	332 52
Timoke	79	1,138	148 41
Taylor & Passmore, (Cortez)	5	982	160 43
Tannehill, (Eureka)	3	1,338	106 35
Victoria	4	1,176	91 29
Washington	12	67	479 52
Whitlatch	18	546	105 97
Zimmerman	5	1,278	71 75

The above table embraces 47 mines, which have yielded more or less bullion during the quarter, and with few exceptions the ore reduced is of a good grade, sufficiently so to admit its being worked here remuneratively. It will be observed that a number of mines, which were included in the previous quarters of the year, do not appear in the present list, as well as that several mines appear for the first time. According to the assessor's returns there are in Lander county, and mainly in the Reese River district, about 75 mines which have produced bullion during the past year. As we have remarked, the ore worked is generally of a high grade, as the average yield per ton will show. A considerable number of the mines embraced in the quarterly lists were subjected only to testing operations, and the general result must be deemed encouraging. In the case of the Savage mine, the average yield of the ore is less than in several quarters preceding, but is still high, being $103 25 per ton. The yield of the Washington, Chase, Buel North Star, Great Eastern, Semanthe, Magnolia, Florida, Timoke, Idora, Metacom, Taylor, and Passmore, &c., is excellent, and as most of them are pretty well developed, they may be fairly classed henceforth among the producing and paying mines of the Reese River district.

Quarter ending March 31, 1867.

Names.	Tons.	Pounds.	Average per ton.
Black Ledge	5	569	$210 32
Buel North Star, 1st class	31	422	182 56
Buel North Star, 2d class	16	161	51 52
Cortez, no name given	47	1,678	238 69
Dolerhide	3	1,735	239 90
Diana	195	717	94 30
Florida	101	1,394	351 96
Farrell Co.	12	981	204 67
Fenian Star	3	....	36 44
Fuller	4	....	349 34
Great Eastern	137	669	345 93
Glasser	2	700	200 75
Idora	1	....	192 56
Kelly and Ensign	3	81	129 18
Leggett	5	1,121	50 62
Lady Franklin	1	....	134 48
Livermore	4	738	267 54
Magnolia	13	1,536	371 82
Mountain View	1	....	159 78
Miller & Co.	1	1,836	234 45
North Star (Manhattan Company)	384	360	141 37
Morgan & Muncey	28	782	103 36
Miller	1	634	76 36
Montauk	1	1,295	144 00
Martine	1	900	88 90
Niagara	3	148	60 08
O'Dair	4	1,753	284 71
Peaslee	1	....	96 66
Patriot	1	467	64 08
Richmond	5	657	53 73
Red Bluff	1	650	55 01
Stranger	3	1,635	48 00
Semanthe	7	254	132 68
Swaney	1	1,895	530 05
Story	3	1,700	204 98

Quarter ending March 31, 1867—Continued.

Names.	Tons.	Pounds.	Average per ton.
Savage Consolidated	290		$62 77
Silver Lead	3	1,492	88 46
Timoke	100	1,042	276 5
Vineyard	5	1,392	66 0
Vandyne	1		193 3
Washington	4	1,561	312 37
Yankee Blade, no name given	1	427	250 04
W. C. Blake	1	1,628	76 08

On comparing this table with that of the preceding quarter a marked improvement will be observed in the average yield of the ore produced by several of the leading mines, as well as in their increased production. For instance, the Florida produced during the last quarter 101 tons of ore, which gave an average yield of $351 96 per ton, against 13 tons yielding an average of $255 60 the previous quarter; the Diana, 195 tons which averaged $94 30, against 143 tons which averaged $91 18; the Great Eastern, 137 tons which averaged $345 93, against 287 tons which averaged $217 94; the Magnolia, 13 tons which averaged $371 82, against 6 tons which averaged $338 23; the North Star of the Manhattan Company, 384 tons which averaged $141 37, against 69 tons which averaged $83 90; the Timoke, 100 tons which averaged $276 59, against 79 tons which averaged $148 41; and the Savage, 290 tons which averaged $62 77, against 451 tons which averaged $103 25. The falling off in the quantity and quality of the ore from the Savage is remarkable, but we believe the explanation is that only a small proportion of the ore reduced was extracted from the mine during the last quarter, but that the great bulk of it was taken from their dump pile. On the other hand, the improvement in the production of ore from the North Star of the Manhattan Company, and its increased average yield of bullion, is more remarkable. Perhaps the most striking increase, both as regards the product of ore and its yield of silver, is presented by the Florida, the exhibit for the two quarters being—December 31, 1866, 13 tons, averaging $255 60; March 31, 1867, 101 tons, averaging $351 96. A number of the mines embraced in the present returns are strangers in previous lists; indeed, there is reason to believe that several of them are not the names of mines, but of the persons who delivered ore to the mills for reduction. Two lots are returned from "Yankee Blade," not from the mines bearing that title—both of which belong to companies and are lying idle—but from that part of the Reese River district. One large lot of 47 tons of high grade ore is returned from "Cortez;" we presume it was brought from the Cortez district, but from what particular mine—whether from the St. Louis, Taylor and Passmore, or Nonesuch—is not mentioned in the quarterly statement of the assessor. This loose and inaccurate method of making the return is in direct violation of the statute, and defeats one of its principal objects. Every mill, or arrastra, or reduction works of any character, is required by the law to keep an accurate list of the name of every mine from which ore was delivered, and to furnish a sworn statement of the same to the assessor. Of course, in a district having the numberless locations of Reese river, a person bringing ore to mill may easily impose a fictitious name on the superintendent; but the name of the mine should be required in every instance, and no such unmeaning entries as "Yankee Blade," "Cortez," &c., should be allowed to appear in the statement.

Quarter ending June 30, 1867.

Name of mine.	Tons.	Pounds.	Average per ton.
Amigo	2	320	$56 19
Black Ledge	20	936	104 09
Buel North Star	127	331	163 63
Bonner Ledge	2	882	324 45
Carter and Drake	3	1,295	77 55
Cuba	2	1,095	114 13
Chase	3	350	314 81
Craycroft and Brown	2	222	49 47
Diana	37	936	103 60
Elkhorn	1	1,145	535 41
Empire State	6	740	101 38
Fuller	13	1,330	741 67
Florida, (New York and Austin Company)	173	365	206 10
Farrell and Hixon	5	225	206 77

Quarter ending June 30, 1867—Continued.

Name of mine.	Tons.	Pounds.	Average per ton.
Great Eastern	33	1,235	$70 91
General Cochrane	1	220	232 72
General Siegel	2	1,412	222 36
Guadelupe	4	1,130	155 48
Livermore	6	173	201 84
La Plata	2	1,200	73 80
Liberty	3	1,582	50 23
Magnolia	53	394	120 26
Moses Scramlin	1	955	50 88
Montauk	1	1,490	250 70
North Star, (Manhattan Company)	507	1,557	149 40
North River	19	1,553	211 39
Oleander	2	354	113 40
Oregon, (Dollarhide)	1	120	253 89
Patton and Monroe	1	926	143 74
Perkins	3	963	214 44
Quintero	1	90	63 61
Rough and Ready	2	100	123 90
St. Louis, (Cortez district)	21	1,250	252 53
Storey	1	170	253 79
State of New York	7	1,610	165 26
Semanthe, (New York and Austin Company)	9	530	94 14
Silver Cord	1	1,000	313 86
St. Louis	2	195	73 78
Silver Parlor	4	1,290	77 24
Social and Steptoe, (Egan)	150	....	90 00
Troy, (N. Y. S. M. Company)	38	428	87 66
Timoke	96	1,460	241 49
Virginia	2	930	258 21
Vineyard	9	124	229 57
Washington	3	1,695	447 69
Wall and Isabella	14	1,560	137 07
Whitlatch Union	1	500	306 78
Whitlatch No. 2	9	1,458	187 18
Young America, (Mount Hope)	1	158	80 61

The whole number of tons of ore reduced during the quarter was 1,438, which produced the sum of $232,335 57. The average yield of 1,438 tons was $161 56 per ton—a result that maintains the character of Lander hill, from which it was chiefly obtained, for yielding a high grade of ore. On comparing the present table with that of the previous quarter, notable fluctuations and uniformity will be observed. For instance, the North Star mine of the Manhattan Company produced during the last quarter 508 tons of ore, which averaged $149 40 per ton, against 384 tons, averaging $141 37 per ton, in the former quarter; the Florida produced 173 tons, which averaged $206 10 per ton, against 101 tons, averaging $351 96, of the former quarter; the Buel North Star produced 127 tons, which averaged $163 63 per ton, against 31 tons of first-class ore, averaging $182 56, and 16 tons of second-class ore, averaging $51 52 per ton, of the former quarter; the Timoke produced 97 tons, which averaged $241 49 per ton, against 100 tons, averaging $276 59 per ton, of the former quarter; the Fuller produced 14 tons, which averaged $741 67 per ton, against 4 tons, averaging $349 34 per ton, of the former quarter; and the Diana produced 37 tons, which averaged $103 60 per ton, against 195 tons, averaging $94 30 per ton, of the former quarter. The most marked fluctuation is that of the Great Eastern, which produced during the last quarter only 24 tons, which averaged $70 91 per ton, against 137 tons, with the remarkable average of $345 93, for the quarter ending 31st of March. Considerable exploration has been carried on in the Great Eastern during the last three months, the result of which has not been made public. Several mines, which produced bullion in the former quarter, are not included in the above table; and others again, which were not mentioned then, appear in the present return. The most noticeable of the latter is the Gilligan mine of the Social and Steptoe Company, in Egan cañon, which appears in the present table with the good product of 150 tons, averaging $90 per ton, which is scarcely 60 per cent. of the silver contained in its peculiar ore. The returns of the last quarter are generally encouraging.

Following the organization of Reese River district, were in the same year discovered and organized those of Simpson's Park, adjoining it on the south, and further south that of Big Creek; north was Mount Hope and Grass Valley; southeast were Smoky Valley and Santa Fé, and northwest was Ravenswood. These nearly surrounded Austin, and were from five to fifteen miles distant. All but Ravenswood were in the Toiyabee mountains; and the fact that large veins of silver-bearing quartz were found outside of this district gave an impetus to prospecting, and the mountains in their entire length were explored and districts formed throughout before the termination of the year 1863.

AMADOR DISTRICT.—Immediately north, in Lander county, was formed the district of Amador, where the veins and croppings created a great excitement, and a populous and busy village was built in a few weeks' time. This appeared the most promising of the districts during the fall of 1863, but many of the ledges not proving, from the depth to which they were explored, as rich as their croppings promised, the district is not so favorably regarded as formerly.

The Amador Ledge has been explored by an incline to the depth of 200 feet and upwards. It dips to the northeast, at an angle of about 15 degrees. During this exploration much good ore was taken out, and its owners express confidence that when the reduction of ores becomes simplified and cheapened the mine can be worked at a profit. There are many veins like the Amador, which await the same events for their development.

The Chase Mine.—In the southern part of the district is the Chase mine, which has the appearance of being rich. It is but slightly developed, yet shows quantities of ore of an almost pure sulphuret of silver. Operations have been suspended on it for several months, but it has lately passed into the hands of an eastern company, and work will be prosecuted on it hereafter.

Other Mines.—In the vicinity of the Chase are veins, some of which give assurance of value. The want of capital, and the lack of knowledge of mining engineering, have been obstacles in the way of development of many mines in this district supposed to be rich.

MOUNT HOPE, CUMBERLAND, COLUMBUS, MOUNT VERNON, INDIAN, AND WALL STREET DISTRICTS.—As before said, the year 1863 was distinguished for explorations, but prospecting was then chiefly confined to the Toiyabee range, and to those ranges east and west, next parallel. In the Toiyabee to the north of Austin and Amador, and in Lander county, were organized the districts of Mount Hope, Cumberland, Columbus, Mount Vernon, Indian, and Wall Street, extending as far as 35 miles north, being continuous and including both sides of the mountain. The mines of these districts are almost entirely undeveloped, their croppings alone being known. From these croppings some rock has been taken from which encouraging results have been obtained, but this vast area, probably well stored with silver, is neglected and comparatively unknown, awaiting the coming of the capitalist and a denser population. It offers favorable conditions for working mines, as it includes one of the highest peaks of the Toiyabee mountains—Mount Hope—which attains an altitude of about 10,000 feet above the sea, in the deep cañons of which run a number of streams capable of furnishing water-power for driving machinery. Its sides are covered with groves of pine, and where its streams debouche into the plains at its base are tracts of good agricultural lands. In the valleys which skirt its foot are some farms; but its mineral wealth lies entirely neglected. One district has been noticed by an experienced mining engineer, Mr. J. H. Boalt, who, after as close an examination of the ledges as their slight development would allow, reported that they were true fissure veins, of size from 4 to 15 feet in width, and of unmistakable value. Several of the veins were cut transversely, and the ore taken for trial; and it was proved that they contained silver in paying quantities; the assays showing a value of $100 and upwards to the ton. This is the only reliable examination made of the ledges of the district. Superficial as it is, it presents some proof of the value of a neglected district, and an indication that the great extent of country which this mountain embraces bears in its bosom the same precious veins which labor has proved to exist in other parts of the Toiyabee range.

CORTEZ DISTRICT.—The Cortez district, Lander county, comprises the northern terminus of the range east of the Toiyabee, and includes the lofty peak of Mount Tenabo. It is 65 miles north, by 15° east of Austin. It was organized in 1863, and operations were instituted on a number of small veins in the northern part of the district. In 1864 a mill was constructed which attempted the reduction of the ores; but from the incompleteness of the mill, and the inexperience of the managers, the workings were not successful, and as a consequence disappointment ensued, and the district was long neglected. Subsequently, discoveries were made of mineral existing in a mammoth vein or broad stratum of quartzite which coursed through Mount Tenabo, and these bodies of mineral having proved valuable, attention is again attracted to the district. The following description of this mountain and the stratum or vein which bears the mineral, is from the Reveille, of January 4, 1867:

> This vein is embedded in the bosom of Mount Tenabo, a peak 11,500 feet above the level of the sea, and upwards of 5,000 feet above the surrounding valleys. Its base, up its side to the vein, is covered with a scrubby pine; while its summit, and 1,500 feet below is overgrown with grass and shrubs. The scarred and rugged mountain looks eternal. Some 3,000 feet above its base a vein of silver-bearing quartz cuts its face obliquely, burying itself in the mountain at one end, and penetrating into the valley at the other, after stretching out in palpable view to the length of 18,650 feet. Its width is 400 feet. This vein, or perhaps more properly stratum, of the mountain formation bears beds of ore, the extent of which is only conjecture. The workings at various mills have proved encouraging. The vein is encased in crystalline limestone. Twenty locations have been made, with the following names and dimensions: Commencing at its greatest point of altitude is the Chieftain, Genesee county, 1,400 feet; Murphy Company, 800 feet; Gill Company, 800 feet; Taylor and Passmore, 800 feet; De Witt Company, 450 feet; St. Louis Company, 2,000 feet; Meacham and Brothers, 400 feet; Niagara, 400 feet; Savage Company, 400 feet; Nebraska Company, 1,200 feet; Cortez Giant, Mount Tenabo Company, 4,000 feet; Elmore Company, 200 feet; Russell Company, 600 feet; Continental Company, 1,000 feet; Argentine Company, 1,000 feet; Empire Company, 800 feet; Conn and Brothers, 400 feet; Traverse Company, 400 feet; and the Anna Burr Company, 2,000 feet. The latter claim is somewhat broken, and at its termination the vein penetrates the earth and is lost altogether. The vein disappears also at the upper boundary of the Chieftain. It has been opened at several points along its course, in every case disclosing mineral. The Gill, Taylor and Passmore, and St. Louis locations, near the upper end of the vein, have been worked, the two latter considerably: the Cortez Giant, which lies near the centre of the vein, is the most fully developed, and has yielded a considerable amount of bullion this season. Some work has also been done on the Continental, situated towards the lower end of the vein, with about the same results as in the other cases specified. Of this vein there is little exact knowledge, but that it stands out upon the mountain face, a large, palpable fact. It will probably be developed. And when that day arrives we believe the Nevada Giant will be regarded as among the remarkable veins of the world.

The Continental.—There are but few claims upon this vein developed to any great extent. Upon the Continental, explorations have been conducted under the superintendency of D. T. Elmore, which have shown a lode about 300 feet in width, containing three strata of ore of from five to eight feet in thickness. These have been mined to some extent, and the ore reduced at the mills at Austin, with a result of about $150 per ton. This is owned by a Maryland company, which, being assured of the value of the property, has thought best to await the coming of the railroad, that operations may be carried on cheaply, and the greatest profit secured. The trans-continentalrail road will pass within a few miles of these mines. When completed to this point it will cheapen material of consumption by the lessening of freight, and the time of its completion is so near that none can doubt the propriety of waiting for it.

The Cortez Giant.—The Mount Tenabo Mining Company, a San Francisco organization, was formerly called the Cortez Company, and its operations have been previously noticed. It possesses a claim called the Cortez Giant, of 4,000 feet in length, upon the Nevada Giant ledge, and has prosecuted mining upon it to some extent. It has lately been under the charge of H. J. Hall, but is at present superintended by H. H. Day. A main shaft has been sunk, which has now a depth of 214 feet, partly planked, and divided into two compartments. From the shaft several levels have been run; the second from a depth of 121 feet, which has explored the vein for a length of 217 feet, finding a stratum of ore of eight feet in thickness, worth from $65 to $100 per ton. The shaft passed through the ore following the dip of the ledge at a depth of 171 feet. From the greatest depth a third level has been started, which it is expected will find ore as good as that developed above. Steam hoisting works are expected to be completed within two months, when work will be prosecuted to greater advantage than at present. A mill of 15 stamps belongs to the company, and is usually employed in working the ores of this mine. In this property the vein assumes its greatest proportions. Its croppings tower many hundred feet in the air, in wild and rugged grandeur. Viewed from a distance, as it skirts the brow of the mountain, this curious line of croppings presents the appearance of a huge balustrade to some colossal architectural structure, with the round and treeless summit of Mount Tenabo, 11,000 feet above the sea, rising gently and gracefully, as the crowning dome above.

The St. Louis.—North of the Cortez Giant is the St. Louis, owned chiefly by A. L. Page and Simeon Wenban. In the claim is a body of silver ore from which selected lots have been transported to Austin, producing from $200 to $300 per ton. Work is now progressing, and an incline in the body of ore, some 50 or 60 feet in depth, gives promise that the mine will prove remunerative.

Taylor and Passmore, Gill, &c.—The Taylor and Passmore, Gill, and a few other locations have been slightly developed, and good ore obtained. Upon no others than those mentioned has sufficient work been done to demonstrate any value in the property.

In the northern part of the district are some small veins encased in granite, which in time may prove valuable. Among these are the Berlin, Wenban, Veatch, and a few others, upon which work has been done, and ore of a favorable character obtained. There is no mining doing upon them at present. There is some grazing and agricultural land in the neighborhood.

The district is pleasantly situated. No grander scenery is furnished by the wild mountains of the interior, nor of the Pacific coast. From the high peak may be seen nearly all Nevada, with its ranges of mountains, its isolated hills, broad valleys, and desert plains. The Indians called it "Tenabo," which we translate to "look out;" and it is really a lookout mountain. Looking westward from the summit in a clear day, the white peaks of the Sierra Nevada are seen stretching along the eastern boundary of California, and many a hill, bearing silver, gold, and copper, lie between. Northward, but 25 miles distant, drawn athwart the vision, is the long and winding line of the Humboldt river and its valley of meadow or sandy plain. Eastward successions of hills and valleys meet the eye. In the other direction the dim atmosphere of Smoky Valley limits the sight, but glimpses of the summit of Mount Hope, Bunker Hill, and other peaks of the Toiyabee range which pierce the clouds, trace the line for 150 miles to the south. The district is attractive both for its scenery and its resources.

NEWARK DISTRICT.—Newark district, Lander county, was organized in October, 1866. It lies on the eastern slope of the Diamond range of mountains, about 85 miles east of Austin. Its geological formation is of slate and limestone, the latter carrying a great abundance of fossil shells. Deep chasms are cut in the mountain side which exhibit the character of the rocks. One of these chasms or cañons is called the Minnehaha. With its towering rocks, sparkling stream, and luxuriant verdure, it offers to the eye a scene of rare beauty. Another is the Chihuahua cañon, where the rocks seem burst in twain by some great convulsion, and stand in perpendicular walls, towering to the height of a thousand feet. This deep fissure exposes veins of silver-bearing quartz, varying from 2 to 20 feet in width. The ore exposed is an antimonial sulphuret, and is supposed to be valuable. A number of the veins have already been tested by workings at the mills in Austin and good returns obtained. A mill, the property of the Centenary company, is now in course of construction in the district, which it is hoped will soon add its product of bullion to the silver current of eastern Nevada. The ledges of the Centenary company best known are the Lincoln and the Chihuahua. Upon the Chihuahua tunnels have been run which exposed the ledge in several places, favorably developing the property. The district is as yet but little known. Like many others in its neighborhood, it invites capital and labor. Now a wide and an almost unoccupied wilderness, it offers many advantages to the miner and the agriculturist. These occupations, being the basis of wealth, will attract in their train other branches of trade and industry. The mountain is partially covered with pine and mahogany, furnishing lumber and fuel. At the base, and between it and the White Pine range to the east, is a broad valley where farms can be secured. The small streams which run from the mountains, on either side, will supply water for irrigation and mining; the neighboring hills will furnish a market for agricultural products. Within the valley are salt springs, and acres of land are covered with this useful article, a demand for which is created in the reduction of silver ores. A visitor to this district about the time of its organization writes: "The future of our State is encouraging. The good time may be delayed, but it will come. Where there is a foundation for prosperity, there need be no apprehensions for the future. The foundation lies broad and deep in Nevada; the rest is the work of time and man."

WHITE PINE DISTRICT.—The District of White Pine was organized in the autumn of 1865, and received its name from the species of wood growing upon the mountain. That portion of the range bearing the name of White Pine is about two degrees in length, is lofty, and generally covered with pine. It has not been much explored for mines, except in the district now mentioned. Here a number of veins have been located which are represented to be valuable. The district is about 90 miles east of Austin, and is in Lander county. A company called the Monte Christo commenced in July last the development of a property, but the progress made, or the results obtained, have not been ascertained.

DIAMOND DISTRICT.—Diamond district, also in Lander county, lies upon the western slope of Diamond mountains, and is 80 miles east, by a few degrees north, of Austin. It has been organized about three years, and some work has been done in exploring and demonstrating the value of the ledges, of which a great number are located. Ore has been taken to Austin for reduction, which, returning $150 and upwards to the ton, gave proof of value of the veins. They are yet the property of the discoverers, who for want of means were unable to erect the machinery necessary for their development, and, consequently, have in the Atlantic States and in Europe sought the aid of capital.

EUREKA DISTRICT.—The Eureka district, Lander county, was organized in 1864. and lies 60 miles almost directly east of Austin. The geological formation is limestone, with veins or bodies of metal-bearing quartz. The chief characteristic of the ore is an argentiferous galena, which might be reduced by smelting. Several tons sent to the mills in Austin yielded from $150 to $450 per ton. These results are encouraging. As some of the veins are owned by men of wealth in New York, it is expected that measures will be taken for their development. The district is in the midst of a good agricultural and grazing country, and offers inducements to those wishing a free and independent home.

EGAN OR GOLD CAÑON DISTRICT.—Gold Cañon district, Lander county, better known as Egan Cañon, is one of the farthest east of Nevada, being 165 miles from Austin. It was organized in 1863, and native gold showing plainly in the quartz of some of the veins first discovered, gave it the name of Gold Cañon. It lies upon the great trans-continental highway where passes daily the overland mail stage, and is connected with the world by two lines of telegraph. A small mill erected in the year 1864, by Mr. John O'Dougherty, met with success. It is again in operation, reducing ore which returns about $150 to the ton. A mill of increased capacity is in process of construction which it is expected will add to the product of bullion. It is favorably located for accessibility, and the abundance of wood and water give it some advantage.

KINSLEY DISTRICT.—The Kinsley district, Lander county, is distinguished for its massive lodes of copper-bearing ore. It is in the Antelope range of mountains near the eastern border of the State, 45 miles northeast of Egan and 200 miles from Austin. The lodes are large, and ore is represented as being upon the surface which shows by assay from 35 to 50 per cent. of copper, and from $60 to $100 per ton in silver. The district is but little known; its distance from the centre of population and a market render the copper mines valueless for the present. The Pacific railroad now in course of construction is expected to pass through this neighborhood, when the ores may be transported to market. The Kinsley may then become a valuable mining district.

YREKA DISTRICT.—Yreka district, Lander county, is about 75 miles northeast of Austin. Reports of silver-bearing veins have been made; but it is almost entirely undeveloped, and its value is unknown. It is surrounded by a good agricultural and grazing country.

BATTLE MOUNTAIN DISTRICT.—Battle Mountain is a copper-bearing hill, situated about 70 miles north of Austin and is probably in Humboldt county. In 1866 it was formed into a mining district bearing that name. It is an igneous formation, and through the eruptive rocks are veins of quartz associated with red oxide of copper. The ore is brilliantly red and very beautiful. The district borders upon the valley of the Humboldt river, which will soon be traversed by the great Pacific railroad, when its ores will find a market.

The district derives its name from the range of hills or mountains containing the cupriferous veins. In these hills a battle was fought in the summer of 1857 between some Indians and a government expedition under the superintendence of John Kirk, engaged in the survey of a road bearing the name of the Fort Kearney wagon road, Pacific division. It is a low range of hills of about 12 miles in length by five in breadth, fronting on Reese River valley on the east, and terminating in the valley of the Humboldt on the north. At the southern end is Copper cañon, where the Troy and other copper veins are found; and at the northern end is Long cañon, where the Trojan, President, Mayflower, Blue Bell, Capitol, Henrietta, Fanny, Morning Star, and others lie.

There are but few companies formed for operating in Battle Mountain district. The principal are the Emerson and the Austin companies. These are unincorporated.

The Emerson Company.—The Emerson Company is composed of General W. S. Rosecrans, G. W. Emerson, William Plumhof, and others. The company owns the Morning Star, Henrietta, Surprise, Fanny, President, Trojan and Capitol ledges, and extensions on some others. Upon those named, the location upon each is from 1,400 to 1,600 feet, and the veins are from 10 to 30 feet in width. All are developed to the extent of a cut of from 5 to 10 feet in depth crossing the vein from side to side. By this means the width of each vein has been ascertained, and the character of the ore shown. The gangue is quartz and spar intermixed with nodules and numerous veins of red oxide of copper. These veins are of various thicknesses, from a narrow filament to several inches through, and run irregularly through the mass of the vein. They contain native copper; also considerable silver. The mass of the rock will require crushing and concentrating for profitable mining and exportation. This set of mines is at the northern end of Battle mountain, in the neighborhood of Long cañon. The surveyed route of the Pacific railroad passes about two and a half miles north from the locations, and as this great road is expected to be completed to this point before the close of another year it enhances the prospective value of the property.

The Austin Company.—The Austin Company owns the Troy, Mayflower, Blue Bell, and other veins in the district, some of which are at Copper cañon and others at Long cañon. The developments on the Troy consist of an excavation some 12 feet in width and about 15 feet in depth, showing the size and character of the vein. It is estimated that one-fourth of the vein is composed of red oxide of copper having 40 per cent. of metal.

Upon other claims some work has been done, the general aim being merely to hold possession of the property, awaiting the construction of the railroad.

RAVENSWOOD DISTRICT.—Ravenswood, Lander county, situated but 15 miles northwest from Austin, was one of the earliest districts organized in the Reese River country, having been formed in the first year of the discovery of silver here. It is in the same range as Battle mountain, though the latter is almost separated by a low depression, yet it is the northern terminus of the Shoshone mountains. The veins of Ravenswood, which were located for silver, being found rich only in copper, disappointed the locators, and as a consequence the district has been abandoned. It contains veins which assay as high as 40 to 50 per cent. of copper, and contains silver and gold. The district is well situated for economical working, bordering on the valley of the Reese river, and is tolerably well supplied with timber. Like many others it awaits the coming of the railroad, cheap transportation and subsistence.

BIG CREEK DISTRICT.—The Big Creek district, Lander county, was the second organized in the Toiyabee mountains, and it seemed likely at one time to eclipse everything else. A village was built, with post, express and telegraph offices connecting with Austin, with schools, courts, stores and mills, and its prosperity and stability seemed beyond a doubt. Veins were found appearing full of metal, but upon further trial their value consisted in copper, which was not profitable to work, and interest in the district died away. Now no attention is paid to the mines. It is situated on the western slope of the Toiyabee mountains, twelve miles south of Austin. The creek is a small mountain stream, affording sites for water or steam-power mills. It flows through a deep cañon, along which are some good farms and gardens. If the district has not proved remunerative to the miner, it has furnished pleasant homes for the husbandman.

WASHINGTON DISTRICT.—South of Austin 28 miles, in Nye county, and on the western slope of the Toiyabee, is Washington district, organized in 1863, then and the subsequent year the scene of busy operations. The mineral is an argentiferous galena, abundant in quantity. None who have examined the mines with attention can hesitate to decide that they possess value. The veins are from 4 to 16 feet in width, and regular in their formation. Attempts have been made to reduce the ores, but owing to want of skill on the part of the operators they have not been successful. A great number of veins were located, a pretty village was built, and hopes of prosperity were entertained, but the district following the usual course has become almost deserted. Its mineral resources, however, may yet be advantageously developed.

MARYSVILLE DISTRICT.—South of Washington about 15 miles, in Nye county, is Marysville district, organized in the same year and possessing many similar characteristics. Numerous claims were here located, and great expectations were once entertained. It is now entirely deserted except by a few farmers who cultivate the soil of the valleys, irrigating it by the streams which run down from the mountain. The district is well watered and timbered, and offers advantages to the settler.

THE TOYABEE MOUNTAINS.—On the eastern slope of the Toiyabee, and south of Austin, were organized during the summer of 1863 a number of districts, covering that side of the mountain almost continuously for a distance of 75 miles. Throughout its southern extent the mountain rises from the valley of Reese river on the west and Smoky valley on the east, and attains an altitude of 2,000 to 5,000 feet above them. From valley to valley through the base of the mountain the distance is from 7 to 10 miles. From its high peaks and through its deeply chasmed sides run many streams of water affording good sites for mills.

SMOKY VALLEY DISTRICT.—Of the numerous districts organized on the eastern slope of the mountain that of Smoky Valley was among the first. It is in Lander county, 12 miles south of Austin, and includes what were once the busy little hamlets of Geneva and Clinton. Through it run in deep cañons Birch and

Willow creeks and several smaller rivulets, all of which are lost in the valley. There have been many locations of mines made in the district, but they have been generally neglected until the present year. Latterly labor has been prosecuted upon the Smoky Valley ledge, which has developed, at the depth of 200 feet, a lode or series of veins 50 feet in thickness, of which about 20 feet contain pay streaks of ore. Average specimens assay $60 to $150 per ton. The upper part of the lode has proved quite barren, but the results obtained from below give encouragement to the miners. In this district the lodes are generally large, and exhibit themselves in some instances for miles in length upon the surface. They are situated conveniently for mining, and the district possesses advantages of wood, water, and arable land for carrying on cheaply extensive operations.

Santa Fé District.—South of Smoky Valley district, in the same county, is that of Santa Fé, 18 miles from Austin. It is composed of high peaks, precipitous ridges, and deep, rocky cañons. The bare rocks of the ridges and cañons expose to view the white ledges of quartz in great numbers. A feature in the mineralogy of the district is the presence of gold in considerable quantities in some of the veins. Notwithstanding the undoubted value of the veins, however, in both gold and silver, no successful mining has yet been carried on.

Bunker Hill and Summit Districts.—Bunker Hill and Summit districts, Lander county, occupy both sides of Big Smoky creek, and are 20 miles south of Austin. Ore paying from fifty to some hundreds of dollars per ton has been mined; but the veins have been found broken and irregular, and but little success has attended mining operations. This is generally attributed to improper management, and lack of scientific knowledge of the business of mining and the reduction of ores. The stream is one of the largest flowing out of this mountain range, and affords water-power sufficient for a number of extensive mills. Some failures have retarded progress in what appears a superior district. This cannot long continue, for where nature has done so much by offering valuable minerals, building material, and inexpensive power, a pleasant climate and a rich soil, man will sooner or later take advantage of it and reap the reward.

Blue Springs District.—Blue Springs district, in Nye county, 30 miles south of Austin, is so named from a number of deep springs or ponds which lie in the valley at the foot of the mountains. It contains veins of quartz of large size, reputed to be rich in silver, but developments upon them are so slight that their value is not really known.

Smoky Valley Salt Field.—Near Blue Springs, in the great Smoky valley, is an extensive field of 2,000 acres of salt lands, from which is obtained most of the salt used in Eastern Nevada both for domestic purposes and the reduction of ores. Upon this salt field, as upon some others with which the State abounds, the salt rises as an efflorescence, half an inch or more in thickness, upon the surface of the ground, from which it is gathered. A slight rain drives the salt beneath the surface, but under the influence of the sun it soon reappears. Hundreds of tons are obtained from this field annually, and the supply coming from deep springs seems to be inexhaustible. It is furnished for the use of the mills at from $30 to $50 per ton. When it is known that salt in large quantities is essential to the reduction of silver ores, the beneficence of a Divine Providence in furnishing it in such vast deposits and at convenient localities throughout the country can be appreciated.

North Twin River District.—Forty miles south of Austin, in Nye county, is the North Twin River district. Although this region was examined and many claims located early in the settlement of the country, it was not considered of importance until recently, when work upon some of the veins has proved them to be of large size and great value. Deep cañons, with running streams, open to the plain, offering access to the mines and sites for reduction mills.

The La Plata Mining Company, owning mines in this district, is organized under the laws of Pennsylvania. Its chief stockholders are residents of Reading. This company owns the Twin Ophirs, the William Bigler, and other veins situated in Park cañon. Some of the veins are large, and have shown bodies of good pay ore. Work upon one of the Twin Ophirs has developed a chimney or mass of ore of a very singular character, being chiefly iron and resembling steel, but containing from $70 to $150 per ton in silver. A mill is in course of construction, which, in a few months, will probably add something to the stream of bullion already beginning to flow from the districts bordering the Smoky valley. It is mainly built of stone, with furnaces and chimney stack of brick. These materials are conveniently obtained in the neighborhood. It will contain 10 stamps of about 700 pounds each, crushing the rock dry and in a condition for roasting. The property of the company is managed by G. B. Montgomery.

The Buckeye Mining Company is a New York company, and, under the superintendence of Mr. Stephen Kidd, is developing the Buckeye mine, situated in Summit cañon. The vein was discovered and located in 1865. The claim consists of 1,400 feet of the lode running north from the cañon. The vein is encased in limestone, and, although it sometimes narrows down to a mere clay seam in the rock, it appears to be a true fissure vein. Its general width is five feet, occasionally reaching to seven. It has been developed by an incline following the dip of the ledge, which is westerly 65°, to the depth of 100 feet, and by different levels several hundred feet north and south. From these excavations a quantity of ore has been taken which has yielded, at the Austin mills, $106 per ton. The company has located, under the laws of Nevada, 800 acres of woodland, mill-sites, &c. Neither lands nor mines are entered under any law of Congress, nor are any lands or mines throughout this region. The lands are unsurveyed, and there is no land office in eastern Nevada. The laws of the United States give permission to occupy the mines subject to the local rules of miners. Survey and purchase appears to them a useless expense, serviceable only to the surveyors and land officers.

In Summit cañon are other claims, as the Scottish Chief, which is an extension of the Buckeye south of the cañon. This has been but slightly developed, having a shaft 40 feet in depth; its real worth is therefore known only from the greater explorations on the Buckeye. A short distance to the southwest is the Canada vein. This appears on the surface to be about nine feet in width, but the explorations upon it are not sufficient, it being encased in limestone, to determine its extent and character. From the surface several tons of ore have been taken, which give promise of worth.

TWIN RIVER DISTRICT.—The Twin River district, Nye county, is 50 miles south of Austin, on the eastern slope of the Toiyabee range, and is at present regarded as one of the most important districts south of Austin. It receives its name from two pretty streams on the southern border, which, flowing through deep and rugged cañons, enter the valley near each other, and continuing parallel for some miles sink in the plain. The characteristics of the district are its ruggedness, high and precipitous mountains, deep cañons, and its geological formation being granite and slate, while the districts north of it are of limestone. The principal mines are situated in Ophir cañon. These were discovered in 1863 by S. Boulerond and a party of Frenchmen, who located several veins, but did not publish to the world their discovery nor do much towards developing their property. The year following the cañon was entered by George H. Willard and others, ledges located, a district formed, and laws made. From that date the district has been somewhat noted. In entering the cañon from Smoky valley, one feels almost forbidden to advance, so towering and precipitous are the rocks on either side, which appear to close the narrow pass; but winding along at the base of the cliffs is now a well-constructed road. Following this a mile or more the narrow gorge of granite is passed and a cañon of more gently sloping sides, a slate formation, is reached. The granite is generally barren of soil, but upon the summits of the ridges a few low and dwarfed piñon trees are found, which are cut for fuel and with great labor brought to the brink of the precipice and tumbled into the cañon below, whence it is hauled to its place of consumption. Fuel is difficult to obtain, and costs about $10 per cord. At the present date a mill is in operation, and a village called Toiyabee, of 300 inhabitants, has been built.

The Ophir.—The first vein noticed in passing up the cañon is the Ophir. This was discovered and claimed by S. Boulerond and Company in 1863, and is still owned by the same parties. It is a large vein, showing chiefly white quartz, but deposits of good ore have been found in it. The claim consists of 2,400 feet along the ledge. A shaft has been sunk to the depth of 60 feet, from which a small quantity of ore was obtained, worth at the rate of $500 per ton. The developments upon the mine are very slight.

The Orphee, Central Favorite, and numerous other claims have been slightly developed, but have not yet been productive.

The Murphy is the only developed and productive mine in this neighborhood, and its success has given celebrity to the district. It was located by G. H. Willard, John Murphy, Jo. Patty, and others, in 1864, and is 1,000 feet in length. Its course is north and south, dipping to the east at an angle of 46°, and the lode is about 20 feet in thickness. It has been developed by an incline 130 feet in depth, from which levels have been run and ore extracted, worth about $130 per ton. It appears from the working that the ore is not continuous throughout the vein, but exists in chimneys of one to seven feet in thickness, and from 100 to 150 feet broad, with nearly a corresponding interval of barren rock. These chimneys are inclined, having a dip to the north of about 30°. Although much valuable ore has been extracted, a map of the mine, showing its whole size and the excavations made, indicate that but a small portion is touched. There are 41 men employed in the mine, working eight hours each, at $4 per day, and keeping up the labor without intermission. The miners are usually natives of Cornwall, England. The hoisting of water and ore is done by steam power.

The Murphy Mill, belonging to the Twin River Mining Company, is a substantial structure of stone, having 20 stamps and corresponding machinery, driven by an engine of 95 horse-power. The ore is brought from the mine, a few hundred feet distant, in cars. The first process is to pass it through a Blake's rock breaker, which will in a few hours break sufficient rock into fragments of less than a cubic inch in size to supply the stamps for 24 hours. This effects a saving of $2 per ton in the cost of crushing the ore. From the breaker the ore is placed upon a large pan or dryer, which is heated by the gases passing from the roasting furnaces to the smoke-stack, and is thoroughly dried. It is then ready for the stamps. Of these there are 20, weighing 850 pounds each, and they crush 16 tons per day fine enough to pass through a No. 60 screen, or a screen with 3,600 holes to the square inch. Falling from the screens into a tight bin, it is removed into cars standing on a track passing over the tops of the roasting furnaces, and is thus transported to the furnaces, of which there are eight, capable of roasting 16 tons in 24 hours. Seven to nine hundred pounds of ore mixed with a certain quantity of salt, according to the composition of the ore, varying from eight to fifteen per cent., constitutes a charge, and this is roasted from five to seven hours, being constantly stirred. It is then taken to the amalgamating room, in which are six pans taking one ton of the roasted pulp, now mixed with water, at a charge. Here the silver, which in the furnaces was changed from its native condition to a chloride, is again changed to metallic silver, and is amalgamated with quicksilver. The pulp is agitated and ground by revolving iron mullers for about six hours, when it is drawn off into settlers, of which there are six, where more water is added, and, after several hours' agitation, the quicksilver bearing the silver is drawn off, the pulp allowed to run to waste, and the silver taken out. This, after being strained and pressed in leather bags, exhausting the quicksilver as far as possible, is placed in a close retort, and the remaining quicksilver expelled by heat. The crude bullion remaining is then taken to the smelting room, where it is melted and run into ingots, ready for the assayer and for commerce. The establishment is very complete, and presents an imposing appearance. The officers of the company having charge and carrying on the works, are R. B. Canfield, general agent; H. M. Grant, bookkeeper; H. Richards, mining superintendent; Charles V. Baesler, assayer; and Alonzo Monroe, engineer. In working the mill at full capacity, 41 men are required. Besides those in the mine and mill are blacksmiths, ore assorters, and wood choppers, making 100 men employed. In one month 417 tons of ore were milled, producing $36,865. The assay of the ore was over $100 per ton. At the present date the mill is working to its full capacity, and better results than formerly are obtained.

The McDonald mine.—The Murphy and McDonald are locations upon the same lode, the first extending from the cañon northwardly and the latter south of it. It is anticipated that they are of equal value, although the McDonald is undeveloped. Preparations are making, under the superintendence of John H. Boalt, for a New York company to commence explorations and developing the mine.

These mines constitute the basis of support to a busy and prosperous little village, called Toiyabee City, of about 300 inhabitants. This place is connected with Austin by a tri-weekly stage, carrying the United States mail once a week. The distance is 55 miles, and the time of passage about nine hours. From the valley to the town is about two and a half miles along the cañon, and through this distance a road has been constructed at a cost of about $6,000. The work has been very heavy, and under the circumstances a good road is constructed, although its grade at some places is as great as 10°. The road continues through this cañon over the summit of the Toiyabee mountain, and forms a convenient avenue for summer travel, but the passage is generally impeded by snow during the winter.*

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* The books of the county assessor, according to the Silver Bend Reporter, give the following returns of bullion and yield per ton of the mines of Nye county for the quarter ending September 30, made under oath. The amounts are for coin:

Name.	Tons.	Gross.	Amount per ton.
Twin River Company Murphy Mine	800	$107,544 00	$143 43
Belmont Company Transylvania, 1	736	28,856 88	39 33
Belmont Company Transylvania, 2	21	837 06	39 86

Following are the returns of small lots of ore from this county, worked at mills in the vicinity of Austin, and forwarded by the assessor of Lander county. We merely give the number of pounds of ore worked and the gross product:

	Pounds.	Gross yield.
Indian Jim, Hot Creek district	1,915	$90 80
Old Dominion.........do	3,630	206 24
Gazelle..............do	11,314	753 30
Desert Queen, Reveille district	3,083	474 86
Wild Rose ....do	2,277	149 69
North America ...... do	1,172	68 75
Manhattan ....do	2,639	222 01
Lord Byron ....do	2,254	106 85
Button........ ......do	600	8 84
Regan ....do	2,792	30 68
Lexington .... do	2,764	235 00
Peta, Union district	1,971	68 46
Holman, Union district	2,031	295 34

The books of the county assessor show the following annual product of two of the leading mines of Nye county: From October 1 to December 31, 1866, the Buel mill (now the Bel-

SOUTH TWIN RIVER, HOT SPRINGS, EL DORADO, AND PEAVINE DISTRICTS.—The districts of South Twin River, Hot Springs, El Dorado, and Peavine, all in Nye county, continue in the order in which they are named to near where the mountain, which we have traced for 150 miles, falls away into the plain. Although but slightly explored, the opinion is expressed that the mines in the southern part of the Toiyabee range will equal those of other parts, and that this extensive country offers an inviting field to the explorer and the capitalist.

SMOKY VALLEY.—The great Smoky valley, traversed by Frémont in 1845, who mapped Big Smoky creek and Twin rivers, is worthy of special mention. In the centre of it are found remarkable springs of boiling water, throwing a large and constant stream, in which meat and vegetables are readily cooked, and tea and coffee quickly prepared for use. The basin of the spring is from 20 to 30 feet in diameter, and the fountain of boiling water rises in the centre, a constant column ascending by its subterranean force several feet above the surface. There are several smaller springs in the neighborhood, one of which furnishes cold water. The soil about them is fertile, and the climate pleasant and healthy.

The fields of salt in the northern part of the valley have already been mentioned. Throughout it are found good agricultural lands. The climate is more agreeable than generally prevails in Nevada, without extremes of heat or cold. Snow seldom falls and frosts are never severe, although there are localities where frosts have occurred as early as September, sufficient to blight certain species of vegetation. The valley continues, although slight elevations divide it into different basins, into the desert upon the southern borders of the State. In it are other vast fields of salt, and beds of sulphur, alum, and soda, and bordering upon it are the mountains of San Antonio and Silver Peak. These are isolated and singular in their formation, and appear as if thrown into position by some violent convulsion of nature. The mining districts of this region are among the most important of the State.

SAN ANTONIO DISTRICT, comprising the mountain of that name, is situated about 20 miles southeast of the southern terminus of the Toiyabee mountains, and about 90 miles from Austin. Several companies are engaged in mining here with some success, and ore is extracted which returns from reduction an average of $200 per ton.

The Liberty mine, owned by George Seitz, has been continuously worked during the present year. It is, so far, the most extensively worked mine in the

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mont Company's) reduced 904 tons of ore, producing bullion of the value of $52,712 24, being an average per ton of $58 31; the three months following—January, February, and March, 1867—554 tons and a fraction were reduced, yielding $33,041 39, or $59 64 per ton; the next quarter, 125 tons, 1,339 pounds, producing $6,903 02, $54 93 per ton; and 676 tons, 1,010 pounds, which produced $26,439 77, or $39 08 per ton. The amounts added to the production of the quarter ending on the 30th of September, of 736 tons, yielding $28,856 88—$39 33 per ton, and 21 tons, yielding $837 06—$39 86 per ton, swells the total product of this mine for the past year to $148,790 36 in coin. The aggregate number of tons of ore worked is a fraction over 3,917—averaging very nearly $50 per ton. It was reduced in a 10-stamp mill, at best but an inferior one, by the wet crushing process, by which it is not claimed that more than about 65 per cent. of the silver is saved. In connection with the fact that the mine from which the ore was obtained is practically inexhaustible, and can be made to furnish almost any amount of ore, the above figures will furnish a basis upon which to estimate its great value. During the same period, the Murphy mine, of the Twin River Company, situated in Ophir cañon, as is shown by the books of the assessor, has yielded as follows: first quarter—626¼ tons, averaging $132 49 per ton, $83,007 96; second quarter—1,161¼ tons, averaging $84 18 per ton, $97,775 08; third quarter—804¼ tons, averaging $92 94 per ton, $74,863 17; fourth quarter—800 tons, averaging $134 43 per ton, $107,544, making a total of $363,190 21 in coin in a twelvemonth. The aggregate quantity of ore worked is 3,393¼ tons, and the average yield per ton a fraction over $107. We are informed that the Murphy mine is now in a condition to supply ore for another mill of equal capacity as the one in use, a number of levels having already been run which disclose hundreds of feet in length along the vein, and for a depth of near 200 feet a compact mass of solid ore some 10 or 12 feet thick.

district, and bids fair to be remunerative. A depth of 200 feet has been reached and no water obtained. The mountain is dry, barren, and broken. A few miles to the northwest are the Indian springs, where two small quartz mills have been constructed. As more vigorous work is now prosecuted upon the mines of this district than formerly; they will probably soon take the rank in public esteem to which their value entitles them.

SILVER PEAK, RED MOUNTAIN, PALMETTO, LIDA, AND EDMONTON DISTRICTS.—The districts of Silver Peak, Red Mountain, Palmetto, Lida, and Edmonton comprise the southwestern part of the territory which has been prospected by people who have made Austin their base of operations.

Silver Peak and Red Mountain are contiguous, lying about 150 miles south by west from Austin. Silver Peak is a small, precipitous mountain, through which, lying at a low angle, cuts the Vanderbilt vein, cropping on all sides. The value of this vein has been very highly estimated. Other good veins exist in the district.

In the valley skirting the eastern base of the mountain is an extensive salt field, covering an area of 30 square miles, and capable of furnishing an unlimited supply of salt.

The Red Mountain district, a few miles east of Silver Peak, is distinguished for its production of gold.

Great Salt Basin Company.—The mines of these two districts are chiefly owned by a single company, the Great Salt Basin G. & S. M. Company, organized by S. B. Martin and John W. Harker. They have already a mill of 10 stamps, which has produced considerable bullion. The company is about to erect two other mills of greatly increased capacity. Mining is to be carried on systematically. The superintendent is Mr. J. E. Clayton, a competent mining engineer, and the nominal capital $3,000,000. The company owns many mines in these districts, the principal of which are the Vanderbilt, Pocatillo, and Sisson. The bullion obtained at the mill from the Vanderbilt ore is worth $2 per ounce, while that of Red Mountain is chiefly gold.

The developments in Palmetto district have proved several of the veins to be large and valuable. Gold-bearing quartz is also found, which indicates an abundance of that metal. The district derives its name from a species of date tree, which was mistaken by the discoverers for the palmetto.

COLUMBUS, VOLCANO, CLARENDON, PARADISE, PILOT, MAMMOTH, UNION, AND NORTH UNION DISTRICTS.—These districts are generally classed as belonging to eastern Nevada or Reese river, although they are in the western half of the State. Each has peculiarities, which to describe in detail would be beyond the limits of this report.

Clarendon district contains silver-bearing veins, the character of the ore being the same as that of Silver Bend, southeast of Austin. It has a pleasant village of about 80 inhabitants, with families, a school, and church society, indications of the respectability and good order of the community.

Volcano district is peculiar in its formation, and is supposed to possess quicksilver and coal mines, as well as gold, copper, and silver, but is most familiarly known from its fossils, which are rare and beautiful.

Paradise district receives its name from its pleasant location, and its abundant wood, water, and vegetation.

These are situated from 90 to 150 miles southwest of Austin.

Mammoth district is situated 65 miles southwest of Austin, and its condition is promising. The Mount Vernon Company are prosecuting an extensive system of works, which will develop the mines and prove the value of the district. The Hamilton Gold and Silver Mining Company have several excellent mines in this district, but they are not yet developed to any considerable extent.

Union district lies on the western slope of the Shoshone mountains, the first range west of Reese river, and is about 55 miles southwesterly from Austin.

It contains ledges of undoubted value and facilities for the reduction of ore, such as an abundance of wood and water. The district was early brought into notice, yet its progress has been slow and its production of bullion slight. It is interesting from the beauty and abundance of geodes, valuable to the jeweller and lapidary, found in it. Chalcedory, agate, jasper, and other precious stones also abound.

North Union district is almost entirely undeveloped, but is favorably regarded by those who are acquainted with its mines and resources.

NEW PASS DISTRICT lies almost directly west of Austin, 25 miles distant. It has been organized two years and is yet undeveloped. Mineralogists and engineers have given it a partial examination and have pronounced favorable opinions respecting its resources. The predominant metal is gold. The veins are numerous and well situated for mining.

We may now turn to that portion of Nevada southeast from Austin. This until within the past year was to the general public a *terra incognita*, and believed to be, as it was represented upon the maps, an inhospitable desert, treeless and verdureless, and barely subsisting the few miserable Indians who wandered over its barren plains. But the prospector at last ventured upon its exploration, and the results have been unexpectedly important. A country of vast extent has been unveiled to the world; the rocks seamed with veins of silver, and the valleys abounding in valuable grasses. Not repelling the explorer, it invited him on, until at last the chorography of the country has been made known. The western slope of the mountain bordering Smoky valley on the east had been slightly explored, and the districts of Jefferson, Manhattan and Santa Clara formed.

Under the general belief prevailing that silver-bearing ledges found elsewhere than in the Toiyabee were exceptional, little attention was paid to the discoveries reported to have been made in these districts until subsequent to the discovery of the ledges of Silver Bend. Since then more attention has been paid to them, and they are now found to be of some importance. Little, however, has been done towards the development of any mine in them.

SILVER BEND.—A section of country southeast of Austin bears the general name of Silver Bend. It was first entered by prospectors at an early day in the settlement of eastern Nevada, but no discoveries of mineral were made until October, 1865, when ledges cropping out in massive proportions and showing silver-bearing ore were found. But little work was done, or attention paid to these, until May, 1866, when Dr. William Geller, now general agent of the Combination S. M. Company of New York, was attracted by the statement, and paid the locality a visit. He was at once convinced of its worth, and purchased the interest of the locators of the Highbridge ledge, being 3,000 feet in length, for the sum of $24,000 in currency. Soon afterwards work was commenced under the superintendence of L. B. Moore, who is now carrying on the company's operations. Mr. D. E. Buel and others subsequently visited the district, and reports of its wealth were published in the Reese River Reveille, with descriptions of the mines and surrounding country. From that time it began to attract attention from all parts of the State. People gathered in the vicinity; the *terra incognita* of the southeast was explored and many districts organized. The town of Belmont was built, which is now a flourishing village and the shire town of Nye county. The following particulars of the mines have been obtained chiefly from Mr. J. E. Moloney of Belmont. He says of the

PHILADELPHIA DISTRICT.—This district, erroneously called "Silver Bend," is situated about 85 miles south by east from Austin, on the eastern slope of the Smoky range of mountains, in the county of Nye. The principal mines, as yet developed, are situated down towards the eastern base of the mountain, near Monitor valley. It was organized in 1865 with laws similar to those of Reese River district. The facilities for building are good, the preferred material being stone, but brick of a fine quality is made in the neighborhood. Fire-wood exists in such abundance that mills are furnished with fuel at the rate of $4 50 per cord. Timber suitable for purposes of building exists in the surrounding hills, and several saw-mills find profitable employment and a good market for their products. The better quality of lumber, however, is brought from the Sierra Nevada, near 250 miles distant. A more convenient source of supply would be the White Pine range of mountains, lying about 75 miles to the east. There a species of fir tree grows from which an excellent quality of lumber could be obtained. Elsewhere throughout the State, with slight exceptions, the forests are of piñon, cedar or juniper, mountain mahogany and cottonwood, with a few other varieties, all of a dwarfish character, and although excellent for fuel, make very poor lumber. It, however, answers many purposes, and in the district and neighborhood are five saw-mills engaged in its manufacture. Water is found in quantities sufficient to supply the demand, through the medium of natural springs, some of which furnish considerable streams of water. Already water has been obtained in mines and wells, and there can be no doubt that deep mining will supply an abundance of the element for a large population and an unlimited amount of steam machinery.

The geological formation is of slate, with a stratification running north and south and dipping to the east at a high angle, and the veins follow the stratification. A large number of veins have been discovered and located, the principal of which are the Transylvania, Highbridge, El Dorado, and Achilles.

In the district is the village of Belmont, the shire town of Nye county. It is situated in or about the centre of the mineral belt, on a flat through which flows a stream of water. At this point a spur of mountains branches off from the Smoky range and trends to the southeast, dividing the valley into two parts—that on the north called Monitor, and that on the south called Ralston valley. In this spur, and east of the town, are the principal mines of the district. The site opens out southward into Ralston valley, presenting a fine view of the country south, and the range of mountains in which are the districts of Manhattan, Argentoro and others. Though this place is scarcely a year old, it presents the appearance of a well-established centre of trade, having substantial stone and brick fire-proof buildings, and many good frame ones. A weekly mail route is established from Austin to this place, and is extended on to Pahranagat. Between Belmont and Austin the mail is carried in a four-horse stage, which runs tri-weekly, and carries Wells, Fargo & Company's express every trip. The express, therefore, does the chief letter-carrying, its superior convenience entirely eclipsing the weekly mail. A weekly newspaper, the "Silver Bend Reporter," is published, and is evidence of the enlightened state of society peopling this distant frontier. Banks, assay offices, schools, &c., are established, with other institutions and business that go to make up a flourishing town.

The Combination Gold and Silver Mining Company, already spoken of, is a New York organization, owning mines and other property in different parts of eastern Nevada. In Philadelphia district it has a claim of 3,000 feet upon the Transylvania ledge, which is so developed as to leave no doubt of its worth. This is the most northerly portion of the vein yet developed. An incline has been sunk on the ledge to a depth of 170 feet, where it shows a width of 22 feet inside of casings, with a large body of ore. It is estimated that the vein will average by the wet process of working, $150 per ton. This seems a very high estimate and needs the corroboration of thorough trial. The vein is pierced by two tunnels at a depth of 120 feet, and separated by a distance of 700 feet, from the termini of which levels have been run north and south, in all about 800 feet, thus to some extent proving the ledge and preparing it for mining.

The company have in course of construction a mill of 40-stamp capacity. It is rapidly approaching completion, and will soon be in operation. For the better working of the mine a perpendicular shaft is sunk, which will pierce the ledge at a depth of 600 feet. The sinking is now in progress.

Belmont Silver Mining Company is composed of Messrs. J. A. McDonald, J. W. Gashwiler and S. M. Buck. The mining property lies south of the Combination Company's and joins it, being on the same ledge. It was formerly known as Buel's Highbridge, having been owned and developed by Mr. D. E. Buel. This gentleman, when attention was first drawn to the district, purchased the location, 300 feet, for the sum of $9,000. This was in June, 1866, and he immediately commenced the erection of a 10-stamp mill, putting it into operation on the 1st of September following. The mill was prepared only for wet crushing, or working ores without roasting, and was expected to save only 60 per cent. of the silver contained in the ore. It was very incomplete, having for some months only the machinery standing, without roof or enclosing building; yet in about seven months it turned out upwards of $100,000 in bullion. The ores worked were chiefly from or near the surface. Since it has gone into the possession of its present owners, extensive developments have been undertaken under the direction of S. M. Buck, civil and mining engineer. The results are said to be satisfactory. At the present time the company is constructing a 20-stamp mill which they hope to have in operation before the close of the year. The same parties are also owners of a claim of 400 feet, known as the Wood & Buel mine, on the Transylvania No. 1, a parallel vein to the Transylvania No. 2, or Highbridge, and 100 feet from it. There is some difference of opinion respecting these veins—whether they are really two distinct veins, or one a break from the other. Their parallel course and great similarity of gangue and ore impress many with the belief that explorations will prove them to be but one lode. Upon the claim last mentioned some work has been done, and a depth of 75 feet attained on it, where it is found to be from six to ten feet in width. The ore taken out has been reduced at the mill, and is said to have produced from $70 to $100 per ton. A less return is given in the report published by the assessor.

The McAleer Company is a company formed in Frederick City, Maryland, and has been previously mentioned as the Continental, owning property in the Cortez district. Its mining property was the location of Moore and Martin, and comprises 153 feet on the great Transylvania vein, next south of the Wood and Buel location. Since it has been the property of the McAleer Company it has been under the management of D. T. Elmore, who has prosecuted work on the mine to the depth of 140 feet, at which depth the vein is from 6 to 10 feet in width, nearly the entire body being ore estimated to be worth from $60 to $130 per ton. Developments are still going on in preparation for a mill of 20 stamp capacity, now in course of construction, and which it is expected will be in operation this year. The mine, though less in length of vein than the others, is none the less valuable in proportion, and like the others is well situated for working.

The Silver Bend Company owns the next location south on the vein, and is locally known as the Childs and Canfield. The claim extends 2,000 feet along the vein, and the developments show it to be similar in size and quality of ore to the others previously mentioned. An incline shaft has been sunk to the depth of 115 feet, and a level run 150 feet along the vein, proving it permanent and valuable throughout. At a point 800 feet south of the incline mentioned another was sunk to the depth of 105 feet, and levels run north and south, from which 100 tons of ore worked at the Belmont mill (wet process) yielded $91 per ton.

These mines are all on one ledge, and produce good ores.

Most writers stop when the mines of the Transylvania are described, not thinking that others are worthy of note, but an examination reveals the fact that others of a promising character exist.

The El Dorado lies about 1,000 feet west of the Transylvania, and parallel to it. This vein was discovered in the early settlement of the place. It is now owned by Leon, Mullen, Singleterry, and Brown. An incline shaft has been sunk upon it to a depth of 70 feet, developing a vein 8 to 10 feet in width, from which pay ore is obtained.

The Independence and Arizona lie north of the El Dorado, and are supposed to be on the same vein. They are not much developed, but being on the El Dorado vein are esteemed valuable.

North of Belmont one mile is the Silver Champion, which has produced some good ore. It has lately been purchased by T. F. White for an eastern company, and work will probably be commenced upon it soon.

Adjoining this is the Silver Queen, upon which developments are progressing.

Northeast of Belmont is the Silver Cord, Magnolia, and other veins, and southeast, near the Silver Bend Company's mine, is the Achilles. These have been worked to some extent and give evidence of value.

West of Belmont is what is termed the "Spanish Belt," where numerous ledges are found. There are other veins and claims than those mentioned which may prove of value, and many which doubtless deserve the name of "wild-cat."

OFFICIAL RETURNS.—The official returns of Nye county have been published for the quarter ending June 30, 1867. The following list contains the names of the mines, the amount worked, and the average rate per ton:

Name of mine.	Tons.	Lbs.	Average per ton.
Murphy, (Twin river)	805	1,000	$22 94
Transylvania, (Silver Bend Company)	100	632	66 20
Transylvania No. 1, (Belmont Company)	676	1,110	39 08
Transylvania No. 3, (Belmont Company)	125	1,330	54 93
Liberty, (San Antonio)	100	....	208 00
Teutonia, (Milk Springs)	1	46	56 23
Westfield, (Reveille)	......	1,679	408 09
J. Ritter, (Reveille)	......	1,320	101 73
Adriatic, (Reveille)	......	940	102 32
Cornucopia, (Reveille)	1	1,620	611 37
Wild Irishman, (Union)	2	296	262 89
Canada, (North Twin river)	......	1,748	367 76

During the quarter a considerable amount of ore from Nye county was reduced at the mills of Austin, and not mentioned in the above returns. The mills working were the Murphy, at Twin river, 20 stamps; the Belmont, at Belmont, 10 stamps; the Rigby, at San Antonio, four stamps; and the Rutland, at Reveille, five stamps. The last reduced very little ore.

NORTHUMBERLAND DISTRICT.—Sixty miles southeast of Austin is the district of Northumberland, which from recent developments shows evidences of value, and is attracting some attention. It lies on the eastern slope of the Smoky range, and on both sides of the pass through which goes the road leading from Austin to Belmont. The district was organized in June, 1866, and a number of ledges located, few of which were tested. Those now most developed are the Northumberland and Lady Cummings. From these 20 or more tons of ore have been taken and reduced at the mills of Austin, and from $70 to $150 per ton have been obtained. Ore of this quality is reported to be abundant.

DANVILLE DISTRICT lies on the eastern slope of the Monitor range, being the next east of the Smoky range. Between the two lies Monitor valley, similar in its appearance and general characteristics to the Smoky valley and others in the eastern part of the State. The district lies directly east of Northumberland, and 80 miles distant from Austin. It was organized in the summer of 1866, and many ledges located. Of these the Vanderbilt and Silveropolis have furnished ores which, assaying largely, have given some notoriety to the district. From first-class ores of the Vanderbilt assays have been obtained ranging from $800 to $1,700 per ton, and from the Silveropolis as high as $300 and $400 per ton. The assayer remarks that the ores are unusually free from base metals.*

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* It must be observed that these assays afford no reliable indication of the value of a vein. Generally, the ores are selected. There is ore in every district and almost every mine from which high assays can be obtained; but $1,000 or $10,000 ore may exist in a worthless mine.—J. R. B.

The veins at the outcrop are from 20 inches to 12 feet in width. The developments are slight, and none appear to be in progress at the present time. The district is represented to be well supplied with wood and water.

HERCULES' GATE DISTRICT is situated east of and about 150 miles distant from Austin, in the Egan range of mountains. It receives its name from a deep chasm cutting the mountain in two, and through which Major Simpson passed with his exploring expedition in 1859. Silver-bearing veins of good character are reported as existing, but the mineral resources of the district are little known. Bordering on the great Steptoe valley, with numerous streams furnishing power for mills and manufacturing and water for irrigation, it presents features of attraction and value aside from its mines. Copper ore is found in small irregular veins running through the lime-rock or marble in some portions of the district.

HOT CREEK.—The district of Hot Creek is situated about 100 miles southeast from Austin, in Nye county. It was organized in February, 1866, and is of the usual dimensions, 20 miles square. It receives its name from a great natural curiosity, being a stream of hot water of several hundred inches in measurement, and running for several miles in a deep chasm through the mountains. The stream rises from the ground in a large boiling spring at the western base of the Hot Creek range of mountains, and runs eastward through a narrow pass and sinks in a tulé marsh in the valley east of the mountain. For several hundred yards the water retains a high degree of heat, but being supplied by numerous cold springs its temperature is reduced. The water is pure, and is used for culinary purposes. The heat furnished by nature is highly appreciated by those dwelling on its banks. There is in the valleys flanking the mountains a considerable amount of agricultural land, and experiments in cultivation have been made with some success. The chasm, which in places is but a few rods wide, offers facilities for a road through the mountain. A town has been laid out in the district, and is occupied by about 100 people. The geological formation is of limestone, slate, and porphyry, all containing silver-bearing quartz. The limestone appears chiefly on the surface. The mountain rises about 1,500 feet above the level of the valleys, and being very precipitous, offers good opportunities for opening mines by tunnelling. The mining claims of chief notoriety located in the district are the Indian Jim, 1,500 feet; Merrimac, 1,500 feet; Old Dominion, 1,400 feet; Gazelle, 1,200 feet; and the Old Joe, Keystone, Hot Creek, and Silver Glance.

Old Dominion Company.—Upon the Indian Jim and Merrimac some developments have been made. These and the Old Dominion are the property of the Old Dominion Company, formed under the laws of Pennsylvania. The company is prosecuting work on their mines, and constructing a mill of 20 stamp capacity. Upon the Merrimac a shaft has been sunk to a depth of 40 feet, and from this a drift is run which, on the 1st of August, had penetrated the vein a distance of six feet, showing a body of ore estimated to be worth from $100 to $300 per ton. From cuts through the vein at the surface, it is found to be 40 feet in thickness.* It runs north and south, crossing the Hot Creek cañon; that part north of the cañon being the Indian Jim location, and that south the Merrimac. The shaft proves that the limestone, covering the surface has only a depth of 30 feet, and is underlaid by slate and porphyry.

The Consolidation Company is a New York organization, and owns veins throughout various parts of eastern Nevada, but the scenes of its principal operations are in Hot Creek district. Here it owns a number of veins of some promise, though they have not been remunerative. The company has built a 10-stamp mill, called the Manchester. Each stamp is but 250 pounds weight. The mill has not been run successfully and is now idle. The chief mine of the company is the Keystone. Upon the vein a shaft was sunk 33 feet in depth, when, after passing a body of pay ore, the walls came together and the ledge was lost. But slight excavations have been made to recover it, and all work of the company has ceased for the present. There are several other veins in the district belonging to the same company, upon which work has been done, but while the prospects were encouraging, there were no profitable results.

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*It should be understood that veins of this width do not contain pay ore all the way through. Generally, the ore runs in streaks or is found in pockets. The thickness of a vein, therefore, cannot of itself be regarded as infallable evidence of value.—J. R. B.

The district has advantages of wood, which can be procured at $5 per cord; fine water, a pleasant climate, and is surrounded by good agricultural land. These, with the silver-bearing veins, will probably, at no distant day, bring it into notice.

Reveille District.—During the summer of 1866 explorations through the southeastern part of the State were carried on extensively, and many discoveries of importance were made. This region of country had previously been regarded as an inhospitable desert, and was entered with great caution. The impression of its sterility was found to be erroneous, and it is now ascertained that north of the 38th parallel, that part of Nevada, at least, contains but little country that can with propriety be called a desert. In August, 1866, a party composed of M. D. Fairchild, A. Monroe, and W. O. Arnold, discovered an extraordinary outcrop of silver-bearing veins upon the eastern slope of a range next east of the Hot Creek mountains, and about 135 miles southeast of Austin. They immediately proceeded to organize a mining district to which they gave the name of Reveille, in compliment to the Reveille newspaper, Austin. They adopted the mining law of the State, and under it claims were recorded and held. The most promising claims located are the Crescent, August, Mediterranean, Atlantic, National, Antartic, Fisherman, and Adriatic. Many others are located. The last two named are situated on the western slope of the mountain, while the others are on the eastern side. The rock formation is chiefly limestone, and the metal-bearing quartz appears in veins or vast beds in the crust and extending above the surface. These appear of various widths from 20 to upwards of 100 feet. The excavations upon them have not determined their depth, nor whether they are true fissure veins or detached beds. Being in limestone, and appearing in such masses at the surface, has given rise to questions as to their true character. From the August, Crescent, Fisherman, Adriatic, and others, some ore has been taken and reduced at the mills at Austin, producing $150 and upwards to the ton. The outcropping masses of this district are distinguished for the amount of silver they contain. There is but little water in the neighborhood of the mines, but to the west, from seven to ten miles, upon the opposite side of the valley separating the Reveille from the Hot Creek range, are streams affording water for reduction mills should deep mining fail to obtain water for the purpose close at hand. Upon one of these streams the Rutland mill of five stamps has been erected, but as it was prepared only for wet crushing, or from want of efficient management and metallurgical skill, it has not been successful.

Empire District.—Joining Hot Creek district on the south, and about eight miles distant from that singular stream, is Empire district. This was organized in 1866, shortly after that of Hot Creek. It is represented as containing valuable ledges. Ore from them reduced at Austin has yielded as high as $400 per ton. Specimens of great richness are often exhibited, showing chloride, sulphuret, and native silver. The true character and real worth of the district has not been demonstrated.

Milk Springs District is in the Hot Creek range of mountains, and south of Empire. It receives its name from the peculiar appearance of the water arising from a large spring, which, although to the taste pure, is of a milky color. Numerous veins have been located, and some good ore has been obtained. But little work has been done in the district, and its true character cannot be stated. Some of the veins are regarded as of value by persons qualified to judge.

Morey District.—The mineral veins of Morey district were noticed in 1865, by

T. J. Barnes, who penetrated the southeastern country. This gentleman made extensive explorations, and with others organized several districts. Accounts of these were reported at the time in the Reese River Reveille, but they led to no general occupation of the country, nor to the development of any mines. The year following Morey district was reorganized, and labor upon some of the veins is now progressing with fair prospects. It is situated about 100 miles east and a little south of Austin, on a spur of mountain running east from the Hot Creek range. It is as yet but little known.

Pahranagat Distict lies in the southeastern part of Nevada, near the 38th parallel of latitude, and about 115° west from Greenwich. Its distance from Austin is estimated at 180 miles. The mines were first discovered in March, 1865, by T. C. W. Sayles, John H. Ely, David Sanderson, Samuel S. Strut, William McClusky, and Ira Hatch, Indian interpreter. These parties were from Utah, and were guided to the locality by an Indian. A district was formed and many ledges located.* The name given it was the name borne by the Indians living in an extensive valley lying at the foot of the mountain bearing the mineral; the word "pah" meaning water, and "ranagat" any vegetable, as melon, squash, or pumpkin, growing on vines. It is indicative of the agricultural value of the section. The mountain bearing the mineral was named Mount Irish, in honor of Mr. Irish, the United States Indian agent for the Territory of Utah. The place where the discoverers encamped, being at a spring of water in the valley, was called by the Indians Hiko, meaning white man, and the village now at that place, and county seat of Lincoln county, bears that name. The chief physical features of the district are, Mount Irish, a lofty peak attaining an elevation of 11,000 feet above the sea, with other hills and peaks constituting a range of mountains; the Pahranagat valley, of some 30 miles in length and about 12 in width, a portion of which is agricultural land; and its large and singular springs. The mountain, as described by Mr. R. H. Stretch, State mineralogist of Nevada, "is a mass of white porphyritic rock, the flanks consisting of a blackish limestone (abounding in fragments of crinoids and corals) overlying slates and capped with a heavy body of quartzite. On Silver hill and Sanderson mountain, the outcroppings of the lodes are in limestone. On the western slope of the range, crystalline eruptive rocks are abundant."[*] The trend of the mountain range is north and south, and the strike of the veins is generally northeast and southwest, with a slight dip to the southeast, or stand nearly vertical. There have been upwards of 1,000 locations made, the principal of which are the Illinois, List, Crescent, Bay State, New Hampshire, Eclipse, Utah, Ulric Dahlgren, and Victoria. Many others are worthy of mention, but their developments are slight, and the catalogue would be useless.

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* Messrs. Adelberg and Raymond, metallurgists and mining engineers, of New York, in a report on the character of certain silver ores from the Pahranagat district, say: The silver ores from Pahranagat district, the value of which, as determined by 22 assays made for F. Prentice, esq., of New York, will be found in our certificates, present, with but one exception, a single typical class of argentiferous rock, viz: polybasite, of great richness. This mineral contains a somewhat variable proportion of silver, although it has a distinct habitus and chemical character. It is a sulphuret of arsenic (or antimony) and silver, with the formula $9\ \mathrm{Ag\ S} + \mathrm{As\ S}^3$; but a portion of the silver may be represented by copper, and the arsenic by antimony, so that the general formula may be given thus: $9\ (\mathrm{Cu\ S.\ Ag\ S}) + (\mathrm{S\ C\ S}^3\ \mathrm{As\ S}^3.)$ The percentage of silver, according to careful analyses made in Europe, varies from 64 to 72 per cent., and even more.

Pahranagat district, aside from its well-known veins of argentiferous galena, one of which is represented in the specimens submitted to us, seems to carry in its silver lodes principally polybasite. This mineral must be looked upon, therefore, as the characteristic ore of the district, and the principal basis of that silver production, which is rapidly springing up in that rich locality. This mineralogical feature distinguishes Pahranagat from other centres of silver production, such as the Washoe and Reese River districts; and will determine for it a peculiar metallurgical process for the treatment of its ores. We cannot undertake, without a more extended examination, to describe in detail such a process; and content ourselves on this occasion with the following brief opinion:

1. In the case of ores of such quality as the samples marked Hampden, Saturn, Mars, Williams, Moscow, Comanche, Vesuvius, Leonidas, London, Pittsburg, Cliff, Hamburg, Judson, Steuben, Inca, and Mazeppa, we do not see any objection to the use of the well-known process of chloritic roasting and subsequent amalgamation, as carried on in and around Austin; although it is obvious, that only a careful roasting of long duration will convert these ores into a form of chlorides for amalgamation.

2. On the other hand, such exceedingly rich ores as those marked Braganza, Exenica, Gibraltar, and Manchester, would best be beneficiated by the smelting process, the choice of which is indicated by their very character, and the use of which is especially feasible in Pahranagat, inasmuch as the galena veins of that district furnish the very material upon which that process is founded. Another most favorable circumstance is the existence of coal beds in the neighborhood. Although these coal beds, like others of the western coast, belong, no doubt, to the tertiary formation, they will still be of great value to the mining industry of the country, especially as they occur within four miles of the lode.

3. In conclusion we desire to say, that most of the specimens submitted to us are obviously from near the surface; and, judging from the analogy between the mineralogical characteristics of the poorer and the richer ores, we regard it as most probable that future developments in depth will prove all these lodes to carry rich polybasite, which could unquestionably be more thoroughly and easily treated by smelting than by amalgamation.

The valley of Pahranagat lies at an elevation estimated at from 6,000 to 7,000 feet above the sea, but, for so great an altitude the climate is comparatively warm and pleasant. This is accounted for by its being in a measure open to the valley of the Colorado and the warm region of the south. Very slight snow-storms are experienced in winter, and frosts are not severe. Springs and streams afford water for irrigating a large area, which, with the good soil and mild climate, will enable it to furnish such products of the farm, garden, and field as a mining population may require. The springs, of which there are three, Hiko, Logan, and Ash, are natural curiosities, from the amounts of water they pour forth, being from 1,000 to 2,000 inches, and the peculiarity of their high temperature, which is from 65° to 75° Fahrenheit. In the neighborhood of each of these are farming settlements, and at Hiko and Logan are small villages. The total number of inhabitants in the district is now about 300. There are several families residing in the valley, but no schools are yet established. This section having been first occupied by people from Utah and the east, where United States legal-tender notes is the currency, this currency is adopted here, and in that differs from other portions of the State. Early in the present year a mill of five-stamp capacity was erected by W. H. Raymond, and put in operation; but either from inexperience or bad management it proved a failure, and is not operating now. Another mill of five stamps, to work the ores of the List lode, has been constructed and is more successful, although very incomplete. A 10-stamp mill is now in course of construction upon the plan of the best mills at Austin. Its architect and builder is Benjamin Evans, whose experience gives hopes of success. Several attempts have been made to smelt the ores, some of which bear considerable quantities of galena, but so far they have proved failures. It is probable these failures are the consequence of want of knowledge of the composition and inexperience in the reduction of the ores. They have retarded the development of the district, and depleted the pockets of the miners.

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[*] The Mining and Scientific Press, of San Francisco, California, of December, 1865, makes the following allusion to the Pahranagat mines:

We have had placed upon our table some very fine specimens of silver ore from an entirely new mining district, lately discovered about 100 miles easterly of Mono lake, and at least 75 miles distant from any already existing district. It has been named the Pahranagat Lake district, the Indian name of the lake and valley near which the mines are located. The discovery was made in March last, by Messrs. J. Ely, W. McClosky, S. S. Shutt, and three others. The location, as ascertained by running out a line from a known point, is in latitude 37° 34′ north, and 115° 29′ west, which places it in the southeast corner of the State of Nevada.

The ore from this newly discovered region is mainly silver-bearing, and judging from samples of the croppings before us, the mines must prove rich in depth.

Assays have been made by Mr. G. Küstel from five different samples of ore, taken from as many different lodes, three of which present marked peculiarities, and duplicates of all of which are before us. We append the assays, with a description of each sample:

No. 1. Principally carbonate of lead and antimony, yielded at the rate of $867 10, in silver, to the ton of ore.

No. 2. Carbonate of lead, copper, and antimony, $282 25 in silver.

No. 3. Carbonate of lead and copper, with argentiferous gray copper ore and copper silver glance, $1,036 75 in silver.

No. 4. A specimen presenting same characteristics as No. 3 yielded at the rate of $263 70 to the ton.

No. 5. Another specimen similar to No. 3 yielded at the rate of $337 30 to the ton. The two last each presented traces of gold.

A remarkable mountain of salt exists about 70 miles south of the mines.* It is reported to be about five miles in length and 600 feet in height. The body of salt is of unknown depth. It is chemically pure and crystalline, and does not deliquesce on exposure to the atmosphere. Like rock, it requires blasting from the mine, whence it is taken in large blocks as transparent as glass. This would afford an abundant supply to the world could it be cheaply mined and transported, but it now stands in the wilderness, an object for the admiration of the curious, and the inspection of the scientific. The salt to be used in beneficiating the ores, or for domestic purposes, is more easily obtained from the fields in White Pine valley, where it is gathered ready for the table or the mill. This salt field is about 60 miles north of the mines on Mount Irish, and from it salt can be delivered at the mills at Pahranagat at a cost of $40 in coin per ton. The district receives its machinery and most of its supplies from San Francisco. The different routes from that city are by sea around Cape St. Lucas and up the Gulf of California, thence in small steamers up the Colorado river about 600 miles to Callville,† thence by land about 175 miles; or by sea to San Pedro, thence by land via Los Angeles 475 miles; or by Sacramento, the Central Pacific railroad, and Austin. The total distance by the latter route is 650 miles, and freight is taken through at the rate of $200 in coin per ton. The preference is now given to the land route via the railroad.

The Illinois Mine.—The Illinois lode is situated high up on the eastern slope of the mountain, and is cut through by a deep cañon, giving an opportunity to examine the vein, and to open it by tunnels at a great depth. It crops out boldly, showing an apparent width of from 15 to 20 feet. The vein has been opened at several places, and found to be valuable. The Illinois, Indiana, Webster, and other veins of good repute, are the property of W. H. Raymond & Co., of New York.

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* Dr. O. H. Conger, assayer and metallurgist, says in a report on the resources of this district:

"Timber is very abundant in the mountains of this region, particularly in those in which the mines are situated. The water-power is also almost unlimited along the valley streams. Coupled with these great natural advantages, which are indispensable, are immense deposits of salt and the silicate of alumina, and the latter is in the immediate vicinity of the mines. The outcroppings of it over a very large extent of country, which are apparent, prove it absolutely inexhaustible. Its capability of withstanding any degree of heat, to the state of incandescence, is most remarkable. It possesses the property also of hardening by heating, so that in a very short period it becomes almost adamantine. Another very desirable property, as a furnace material, is in its scarcely perceptible expansion and contraction under the most intense degree of heat or cold. Its constituents appear to be, from a hasty test made, silica, alumina, magnesia, and asbestus, the two first minerals greatly predominating, and some strata indicating silica and alumina only. In appearance it resembles chalk, and is as easily carved into any desirable shape. The strata vary in thickness from four inches to six feet.

"These varying thicknesses enable blocks of it to be obtained of any desired size, so that the floors or hearths of reverbaratory and cupelling furnaces, as also pieces entire for the arches can be obtained whole. This will greatly lessen the expense in the construction of the furnaces in this district, which are required for the proper working of the ores, and also they can be much more strongly and perfectly built than with the usual fire brick. Already it is being carried to different parts of the country for refractory purposes. Mountains of limpid salt boldly project through the floor of the valley, and in many places from 100 to 200 feet in height and thickness, so that blocks of a ton in weight or more are easily obtained. One remarkable feature about it is, that it is perfectly pure, containing not a trace of anything but the two elements chlorine and sodium. I believe there is but one other place on the globe where it exists in such a state of purity in workable quantities, and that is Cracow, Poland. This is but another evidence of the state of purity in which the force of nature has left her mineral deposits in this interesting portion of the continent. Native silver is common in many of the lodes of this district on the outcropping ore.

"Copper ore, of the sub-oxide and gray varieties, 80 per cent. metal, and also iron ore of equal richness, are abundant."

† Callville has been reached with great difficulty by one small steamer; but the navigation of the Colorado to that point can scarcely be considered practicable for commercial purposes, in its present condition.—J. R. B.

The Indiana, on Peters's mountain, has been tapped by a tunnel of 125 feet, at a depth of 120 feet below the croppings, showing a pay streak of 6 feet in a vein of 10 feet between the walls.

The Webster, on Raymond mountain, has been struck by a vertical shaft 100 feet below the croppings, with a pay streak of about 10 feet.

The Alameda Company.—This is a New York organization, and owns the List and other mines. The List is a location of 400 feet in length upon a vein which extends through several similar locations. In the claim of the Alameda Company it is most developed, and shows a width of from 5 to 10 feet, bearing two strata of ore, respectively 6 and 18 inches in width. Several tons of this ore have been taken to Austin for reduction, and produced at the rate of $100 per ton, and a number of tons worked at the Crescent mill, near the vein, yielded $80 per ton. The developments consist in an incline 23 feet, and a shaft 50 feet in depth, from the bottom of which a tunnel has been run, but it has not as yet penetrated the vein. Wm. Fleming is the superintendent. The wages paid for first-class miners in this district are $6 per day in currency. Mr. Islin, Captain Dahlgren, and others, are about to commence operations on mines of which they are owners or agents. The district bids fair, with its mineral-bearing ledges and agricultural resources, to become one of importance. It is connected with Austin by a weekly mail, and the road between the two places is naturally good, and has been well improved, so it is easily, safely, and pleasantly passed by heavy freight wagons and travellers. It lies on a practicable route for a railroad from the Central Pacific, at several points on the Humboldt river, to the Colorado at the head of navigation, or to the crossing of the Atlantic and Pacific railroad, should such a road be constructed.

COLORADO DISTRICT.—A recent act of Congress annexed a portion of Arizona to Nevada, and in the section transferred is Colorado district, or the mining region of El Dorado cañon. This is on the banks of the Colorado river, and as yet has had but little intercourse with the original Nevada. It may not be regarded as within the limits of this report to give a description of this district, but as a step-child of Nevada, it is proper to recognize its existence. It was organized in 1861, and a large number of claims located bearing gold, silver, and copper.

Northern Mines.—In July of the present year, a party composed of Messrs. McCan, Beard, Heath, and others left Austin on an exploring tour to the ranges of mountains north of the Humboldt river. There had been rumors of discoveries of gold-bearing veins and placers in those ranges, and also in the Goose Creek mountains, dividing the waters of the Humboldt and Owyhee from Salt Lake. This part of the country was infested with hostile Indians, and it was regarded as dangerous to penetrate it. For that reason it had remained unexplored, yet its very dangers were inviting to the venturesome prospector, whose imagination gave the wild country wealth in proportion to the hardships and dangers attending its occupation. This party of explorers, consisting of eight men, passed the Humboldt river, and going north on about the 117th meridian, crossed a range of mountains, made up chiefly of detached hills or buttes running easterly and westerly, and when upon the northern slope, about 60 miles from the river, discovered gold in placers and *in situ*.

TUSCARORA DISTRICT.—Upon making the discoveries of gold, the prospectors organized a mining district, to which they gave the name of Tuscarora. A small stream running through it northwardly was named McCan. Along this stream for about three miles gold in small quantities was found to exist. It appears very much diffused through the soil from the surface to the depth reached, which did not exceed five feet. Several ledges, or what are supposed to be ledges, were found, showing gold. The party returning to Austin with specimens reported their discoveries, and as is usual upon such occasions an excitement was created, and 100 or more men, well armed for defence against the Indians, and prepared for prospecting, immediately proceeded to the new mining region. A large area of country has already been explored, and mines found in various localities. At the present time the real value of the discoveries is unknown, as but little labor has been expended upon either the gold-bearing veins or in washing the soil. The creek does not furnish water in sufficient quantities for extensive and rapid washing, and therefore unless very rich deposits are found, it is not probable any large fortunes will be realized. It is estimated, however, from the prospects obtained that from $10 to $20 per diem may be made per man, for a score or more of men. Should the specimens of gold-bearing quartz found be any criterion of the value of the veins at great depths, they are rich indeed. The geography of the region is but little known, and it cannot be stated at present whether the waters drain to the Owyhee sink in a basin of their own, or flow to some branch of the Humboldt. A short period will determine all such doubts. The country is described as well adapted for grazing, producing an abundance of grass of a very nutricious character. There are many valleys of large size capable of cultivation, and which, when the treacherous savage is exterminated or subdued, and the miners fill the hills, will furnish pleasant homes to settlers.

About 40 miles east of Tuscarora, and on the southern slope of the range, ledges bearing both silver and gold have been discovered. These discoveries were lately made. No district has yet been formed. The locality is about 50 miles north of Gravelly Ford, on the Humboldt river. T. J. Tennant and party, the discoverers, brought specimens of the ore to Austin, where they were assayed, and showed value. The rock is granite, the veins of quartz running north and south. This is represented as a good farming and grazing country, with grass covering the hills like a meadow. Game, as deer, antelope, hare, and several varieties of grouse, the chief of which is the sage hen, abounds in great plenty.

This new region, which has so long been closed against the pioneer, promises to become an important and wealthy portion of the State.

The following classification of the minerals which characterize the veins of Eastern Nevada is prepared by Charles A. Stetefeldt, esq., assayer and metallurgist, of Austin.

CATALOGUE OF MINERALS.

REESE RIVER DISTRICT.*—*Eastern part of Lander Hill and Central Hill.*—Pyrargyrie, proustite, polybasite, and stephanite predominant; tetrahedrite seldom; few sulphurets of base metals.

Central part of Lander Hill and Union Hill.—Tetrahedrite predominant; pyrites of iron and copper, galena and blende; few polybasite and stephanite.

Western part of Lander Hill and Union Hill.—Argentiferous galena, pyrites of iron and copper, blende predominant; few tetrahedrite. In most veins above water level, horn silver predominant.

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*MINERALS OF REESE RIVER DISTRICT, ARRANGED ACCORDING TO DANA'S SYSTEM. BY EUGENE N. RIOTTE, M. E.

I. NATIVE ELEMENTS:

Native gold, native silver, native copper.

II. SULPHURETS ARSENURETS, ETC:

I. *Binary compounds.*

1. Stibnite, antimonglance.
2. Silverglanze; erubescite, variegated copper ore; galena, blende, copper glance, stromeierite, pyrites, lucopgrites, molyadenite.

II. *Double binary compounds.*

Chalcopyrite, pyrargyrite, proustite, fetrahedrite, polybasite, stephanite, fireblende.

Twin River District.—*Ophir Cañon.*—Species of tetrahedrite containing gold and silver predominant; native silver; blende, pyrites of iron and copper.

Summit Cañon.—Argentiferous galena predominant; native silver, silver glance; blende, pyrites of iron.

North Twin River District.—*Park Cañon.*—Mixture of pyrites of iron, pyrites of copper, blende, argentiferous galena, spathic iron, native silver, pyrargirite, and quartz.

Reveille District.—Argentiferous sulphuret of copper predominant; silver glance, sulphuret of antimony. Croppings contain much horn silver.

Philadelphia and Columbus Districts.—Stetefeldtite (new mineral) predominant; galena; pyrites of copper. Croppings contain much horn silver.

Eureka District.—Argentiferous galena predominant; stetefeldtite.

Empire District.—Stetefeldtite predominant.

Union District.—Stromeyerite predominant; native gold and silver; silver glance; horn silver.

Washington District.—Argentiferous galena predominant; native silver; pyrite of iron and copper, blende.

Summit and Big Creek District.—Argentiferous galena predominant; pyrites of iron and copper, blende, sulphuret of antimony.

Smoky Valley District.—Argentiferous sulphuret of copper, argentiferous galena, blende, pyrites of iron and copper.

Bunker Hill District.—Native gold and silver, argentiferous sulphuret of copper, pyrites of iron and copper, galena.

Santa Fé District.—Native gold; pyrites of iron, copper glance.

Lone Mountain.—Native gold: pyrites of iron and copper.

New Pass District.—Native gold; argentiferous galena, pyrites of copper and copper glance.

Bullion Product.—The actual amount of silver bullion shipped from Austin to Virginia and San Francisco for the 12 months ending August 1, 1867, is $1,455,273 60, the greater portion being in the last five months of the present year. This is ascertained from the way-bills of the express and stage companies.

SECTION XXI.

THE OVERLAND TELEGRAPH.

The subject of trans-continental telegraphic communication has attracted general attention during the past few years, and almost every intelligent person has acquired some knowledge respecting it. I am induced to believe, however, that much may still be learned from the practical experiences of operators along the route. The magnitude of the enterprise, the benefits resulting from it both to

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III. Flourids, chlorids, bromids, iodids:

I. *Binary compounds.*

Common salt, kerargyrite, bromyrite, iodyrite.(?)

IV. Oxygen compounds:

I. *Oxyde binary compounds.*

Red copper, magnetic iron ore, hematite, housnanite, pyrolusite, isilomelan, wad, quarz, opal.

II. *Salts double binary compounds:*

Pyroxene; rhodonite, silicate of manganese; hornblende, muscovite, feldspar, oligoclas and orthoclas, tourmalie, chrysocolla; hubuerite, tungstate of manganese; barytes, gypsum, cyanosite, copperas, glauber salts, apatete, nitre, calcite, carbonate of manganese, chalybite, spathic iron ore, cerusite, trona, malachite, asurite, titanite, tungstate of lead.

the commercial world and the mining community, and the difficulties encountered in carrying it into effect are not yet fully appreciated.

The first practical movement toward the construction of the overland telegraph was made by California.* The Placerville and Humboldt Telegraph Company was organized in 1858, and the first pole of the line from Placerville across the Sierra Nevada mountains was erected on the 4th of July of that year. During the autumn of the same year the line had reached Genoa—then in Utah Territory, now in the State of Nevada—and by the spring of 1859 it had reached Carson, from which point a branch was extended to Virginia City soon after the discovery of the silver mines.

This much of the line was constructed entirely by private enterprise. Neither State nor general government afforded any assistance, though repeated application was made to both. Disagreements between Messrs. Broderick and Gwin, senators of the United States from California, prevented the passage through Congress of a bill introduced by the former in May, 1858, for the construction of a trans-continental line between the Atlantic and Pacific States.

In April, 1859, the legislature passed an act pledging the State to give $6,000 a year to the telegraph line that should make the first connection with an eastern line, and $4,000 a year to the next.

Two companies were encouraged to enter the list—one via Salt Lake city and the other via Los Angeles and the Butterfield stage route through Arizona and Texas.

The dissensions already referred to in Congress retarded the adoption of any of the measures proposed on the Atlantic side, until the 16th of June, 1860, when an act was passed directing the Secretary of the Treasury to advertise for sealed proposals to be received for 60 days after the passage of said act for the use by the government of a line or lines of telegraph to be constructed within two years from July 31, 1860, from some point on the west line of Missouri, by any route the contractor might select, to San Francisco, for a period of 10 years, and to award the contract to the lowest bidder, provided he did not require more than $40,000 a year.

Permission was granted to the successful bidder to use for ten years such public lands of the United States as might be necessary for the right of way and for the purpose of establishing stations for repairs, not exceeding at any one station one quarter-section, and not to exceed one in 15 miles on the whole average of the distance. No pre-emption right to the land was granted. The contract was not to be made until the line was in actual operation.

Certain reservations were also made establishing for the government a priority of use of the line, free from charge until at the ordinary charges for private messages the sum of $40,000 was reached, after which the excess was to be certified to Congress by the Secretary of the Treasury.

Four bids were made in accordance with the proposals advertised by the Secretary of the Treasury, ranging from $40,000 to $25,000, three of which were subsequently withdrawn. The highest bid was that made by Mr. Hiram Sibley, which was accepted.

The parties represented by Mr. Sibley met at Rochester, New York, and concluded upon a series of propositions, which they submitted to the Pacific companies through the agency of Mr. J. H. Wade and Major Bee.

The consolidation was effected in March, 1861, between all the companies on the Pacific coast, by the purchase by the California State Telegraph Company of all the lines belonging to other companies.

The California State Telegraph Company was the oldest telegraph company on the Pacific coast, with a capital of $1,250,000, of which Mr. Horace W. Carpentier, of California, was president, and Mr. J. Mora Moss vice-president.

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*From data published a few years since in the San Francisco Evening Bulletin.

The Overland Telegraph Company was then incorporated promptly by the owners of the California State Telegraph Company, also with a capital of $1,250,000, and under the same board of officers.

On the 1st of January, 1862, the California State Telegraph and the Overland Telegraph Company consolidated under the name of the California State Telegraph Company, with a capital of $2,500,000.

Thus all the lines in California and the overland line to Salt Lake City came into the possession and under the direction of this company.

The eastern end from Salt Lake City to Omaha belonged to the Pacific Telegraph Company.

Mr. Edward Creighton, a gentleman of great energy and experience, was the constructor of the line from Omaha to Salt Lake City. He performed the duties of his position with perfect success under obstacles of a most formidable character.

The California division of the line was reconstructed from Placerville to Fort Churchill, and thence continued to Salt Lake City under the general supervision of Mr. Carpentier, who personally visited all parts of the route and gave the enterprise his earnest attention.

Mr. James Gamble, superintendent of the State Telegraph Company, a gentleman thoroughly familiar with the details of the telegraph system, who had the advantage of experience in the construction of every line built in California by the State Telegraph Company, had the special supervision of the whole work, and much is due to his experience, energy, and skill.

Mr. James Street superintended that part of the work between Ruby valley and Salt Lake City, one of the most difficult sections on the route.

Mr. J. M. Hubbard superintended the construction of the section from Carson to Ruby valley.

On the 27th of May, 1861, Mr. Gamble, as general superintendent of the line, started a train of 30 wagons from Sacramento, loaded with wire, insulators, provisions, &c., with three or four hundred head of oxen, horses, and mules; and, although it was considered late in the season, there was no stoppage on account of storms or bad roads. The snows had begun to melt in the Sierra Nevadas; the mountain streams were swollen into fearful torrents; the roads were cut up into ruts and mudholes, many of which were almost impassable; and forage was exceedingly scarce and dear. Some of the wagons were upset, many of the animals foundered in the mud, but the train went on regardless of every obstacle.

On the 24th of June the first pole was set on the line from Fort Churchill to Salt Lake, and on the 24th day of October the connection with the city of the saints was completed.

History presents no record of such a stupendous work accomplished in so short a time. Five hundred and seventy miles of telegraph line, built through a dreary desert where wood and water were the exceptions, within the brief space of four months! Surely if the Americans are boastful in their speech, their acts are remarkable. Men who build telegraphs across continents, regardless of seasons, deserts, or savage races, have a right to speak well of themselves.

The number of poles to the mile is from 25 to 30, depending upon the character of the country; the average length is about 22 feet; and the kinds of timber chiefly used redwood, pine, cedar, and tamarack. It is customary to sink the poles from three to four feet in the ground, according to the nature of the soil. In soft or marshy ground they require to be braced. Ordinarily they last about two or three years, much depending on the climate and durability of the wood. The best woods used on the California section are said to be the redwood and cedar.

Nearly one-third of the poles had to be hauled from the Sierra Nevada mountains to Austin and beyond, extending to a distance of more than 300 miles, at a cost of four to six cents a pound for freight. But this was the least of the difficulties encountered. Water is exceedingly scarce in these sage deserts, and it often happened that both men and animals suffered fearfully from thirst. It was a constant battle almost every step of the way against the most formidable natural obstacles—alkali deserts, scarcity of water, lack of timber for poles and feed for the animals, rugged mountains and difficult passes. In some places the sand was so soft and shifting as to afford scarcely a foothold for the poles; in others the ground was so hard and rocky that foundations had to be drilled out or built around them with stones. During the progress of the work despatches continued to be regularly transmitted from California to the outer end of the line, where they were copied and forwarded by pony express to the approaching end of the eastern division, and *vice versa,* so that scarcely a day was lost in the use of the telegraph on either side.

Constant communication was also kept up between the operators at the various stations along the line and the office of the company at San Francisco, who were daily advised of the progress of the work.

Poles of sufficient size and strength were very difficult to obtain on other portions of the route.

The cost of transportation was the most expensive item. In the vicinity of Salt lake this difficulty was in part obviated by the adroit management of Mr. Street, who had special charge of that section. It was very generally supposed that Brigham Young, the president of the Mormons, was hostile to the building of the line through the Mormon settlements. Mr. Street was well aware that without his co-operation the difficulties incident to the undertaking would, at least, be greatly augmented. He adopted the policy, therefore, of conciliating the great leader of the latter-day saints—whether by pleasant words or by more substantial tokens of esteem is still a mooted question. His interviews with Brigham on the subject were highly amicable, and I have heard them graphically described. Among other things, it is reported that Brigham expressed surprise at being regarded as an enemy of this important and beneficial enterprise. "Why should we be opposed to a telegraph line?" said he; "we have nothing to fear from it, and everything to gain. It is to our interest, as well as yours, to have the means of communicating with the outer world. Our religion cannot suffer from it, and it will certainly be advantageous to our industrial interests." Whether this be true or not, it is certain he gave his hearty co-operation to the enterprise, ordered out men and teams, and cordially assisted in the construction of the line from Salt Lake City to Deep creek, a distance of 174 miles.

The first through message transmitted over the line, from Salt lake to San Francisco, is interesting in the above connection:

GREAT SALT LAKE CITY,
October 24—7 p. m.

To Hon. H. W. CARPENTIER, *President of the Overland Telegraph:*

DEAR SIR: I am very much obliged to you for your kindness, manifested through Mr. Street, in giving me the privilege of first message to California. May success ever attend the enterprise. The success of Mr. Street in completing his end of the line, under many unfavorable circumstances, in so short a time. is beyond our most sanguine anticipations. Join your wire with the Russian empire and we will converse with Europe.

Your friend,

BRIGHAM YOUNG.

This was in answer to a despatch from Mr. Carpentier, as follows:

SAN FRANCISCO, CALIFORNIA,
October 24, 1861.

To Hon. BRIGHAM YOUNG, *Great Salt Lake City:*

That which was so long a hope is now a reality. The trans-continental telegraph is now completed. May it prove a bond of perpetual union and friendship between the people of Utah and the people of California.

H. W. CARPENTIER.

This was the first through message from San Francisco to Salt Lake City.

The first through message from the Atlantic States contained the following melancholy announcement:

GREAT SALT LAKE CITY,
October 24—7 p. m.

To H. W. CARPENTIER:

Colonel Baker was killed in the battle of the 21st, while in the act of cheering on his command. Intense excitement and mourning in Philadelphia over his death.

STREET.

The line was started from St. Joseph, west, under the supervision of Mr. Creighton, in the summer of 1860. It was built as far as Fort Kearney, via Omaha, that fall, following the north fork of the Platte river. The contract, however, was not made until March, 1861. During the summer and fall the work was vigorously pushed forward by Mr. Creighton and his subordinates. It reached Salt Lake City on the 19th of October, 1861, just five days prior to the completion of the California branch.

Thus, in the language of Mr. Carpentier, "that which was so long a hope became a reality;" thus were the people of the Atlantic united to their friends and fellow-countrymen of the Pacific by an electric bond that annihilated time and space.

Congratulations followed from every State of the Union and from every civilized nation of the world. It was the great achievement of the 19th century.

Within a few days after the completion of the line, the secessionists in Missouri tore it down in several places, and for a while messages were sent east via Hannibal, Missouri, connecting with Quincy, Illinois. Subsequently a change was made by which a connnection was formed between Omaha and Chicago, through Iowa.

From San Francisco to Chicago the distance is about 2,700 miles by the route taken; to New York little short of 4,000 miles.

This is the longest circuit on the American continent, perhaps in the world. For practical purposes it is necessary to repeat at Salt Lake City, Omaha, and Chicago.

Messages either way are rewritten and repeated at Salt Lake City, where an accurate account is kept between the Atlantic and California offices.

Direct communication between San Francisco and New York has frequently taken place, but this can only be done under very favorable circumstances, when there is little or no electrical disturbance. New York and San Francisco held direct communication with each other for the first time on Thursday, November 6, 1862. On that memorable day the Atlantic and Pacific oceans were united in the iron bond of matrimony, from which it is to be hoped they will never be divorced.

The distance is so great, however, and the line subject to so many electrical disturbances that no battery can be made sufficiently powerful to overcome all the obstacles in the way of direct communication. For practical purposes messages have to be repeated at the stations designated for that purpose.

The battery force required for the working of the overland telegraph is small compared with that required in the Atlantic States. This is in part owing to the rarification of the atmosphere, and the prevailing absence of moisture and atmospheric electricity; also, in part, to the absence of trees, which in timbered countries are apt to come in contact with the line and affect the insulation.

At Salt Lake City 50 cups of main battery are used for two wires, one extending east to the repeating station at Fort Laramie, 500 miles, and the other west to Carson, 600 miles.

Experienced operators inform me that it requires double that amount of battery to work the same length of line on any other part of the American continent.

For every space of 30 to 50 miles between Omaha and San Francisco there is an office or repair station, where men are kept for the purpose of protecting and repairing the line. These men are provided with wires, implements, provisions, &c., and hold themselves in readiness to start out at a moment's notice to any point within their range. The expedition with which poles are reset and breaks in the wire repaired is almost incredible. An ordinary break seldom detains despatches more than a few hours.

So skilled do some of the operators become in the art of telegraphing that they are enabled to read by the mere sense of touch or sight applied to the wire or the instrument. Mr. Shaffner relates instances in which operators have read messages by applying to their tongue a small wire attached to the main line. Still more remarkable is the fact that a person near by can discover what is passing by watching the vibrations or electric throbs on the tongue of another. The communication is imperfect, however, and would scarcely be reliable beyond the simplest monosyllables.

Breaks in the line are sometimes very difficult to find. An example is given by Mr. Shaffner where there was a break between two stations. The line was carefully examined all the way through. Apparently it was perfect, yet there was no communication. By testing from each station it was discovered that the break was within a space of a few hundred yards. The wire was then carefully examined, when it was found that a silk cord had been substituted by some designing person so closely resembling the wire that to the eye it presented no perceptible difference.

As an illustration of the wonderful delicacy of the ear acquired by the operators, I must not omit to mention one or two facts connected with the working of the instruments.

In large offices where many instruments are at work, an ordinary visitor almost imagines himself in some extensive clock establishment. There is a perfect medley of ticks, as unintelligible to him as would be a bag of shot rained down over the floor. Yet an operator who has left his seat to say a word to a friend in some other part of the room suddenly starts back, saying "I am called." Among a thousand ticks his particular tick has struck upon the tympanum of his ear. One cannot but think of the final call which, sooner or later, will be sent down from heaven to each one of us among millions of busy souls, and yet be intelligible as this earthly call is to the operator in a telegraph office.

It should also be mentioned, as a characteristic illustration, that operators have an individuality of style or manner as distinctly marked as the differences in chirography. For example, a message is being received at the office in San Francisco from the office in Carson. The superintendent standing by, asks "Who is that at the instrument at Carson?" The operator replies, "Jones is at it now. Thompson was at it a few minutes ago." Presently he adds, "Smith has it now." How does he know all this? Neither Jones, nor Smith, nor Thompson has mentioned his name or said a word on his own account, and yet the fact of each change is perfectly clear to the operator at San Francisco. He knows the style of each man. One makes long dashes and quick dots; another runs a race between dots and dashes; the third is sharp, clear, and methodical. Each has his individual characteristics, which have become as familiar as the tones or modulations of his voice to the ear, or his handwriting or face to the eye. The language of sounds is even considered less liable to error in many offices than that of written signs, and has been of late very generally adopted.

East of the Rocky mountains, the poles are often burnt for miles by prairie fires. The Indians on their hunting expeditions are in the habit of firing the dry grass for the purpose of driving their game. Once started, the flames sweep over the country for hundreds of miles. Emigrant parties camping by the roadside leave their fires burning with little regard to consequences, and many a mile of line has been destroyed through the thoughtlessness of travellers, who, after lighting their pipes, throw the burning match into a bunch of dry grass, if possible, since it presents a peculiar attraction. The passion for destruction is inherent in man; and it may be laid down as an axiom, applicable to all races of the earth, that where there is a chance of doing mischief free from the restraining influences of law, by the burning of a prairie or a forest, human nature is not proof against the temptation. The Indians differ from the whites only in this, that being an ignorant race, they usually have some object to gain in thus destroying the vegetation.

During the summer months, the region of country bordering on the Platte river is subject to terrific thunder-storms, which sweep over the plains with irresistible force. The earth becomes saturated with heavy rains, and the poles being loosened in their foundations, are blown down for miles. Scarcely a day passes, in the early part of summer, without a severe storm on some part of the line between the Rocky mountains and the borders of Missouri. The instruments are "burned" by lightning, or the poles swept to the earth, and the insulation destroyed or obstructed. It is extremely difficult to work through the entire length of the line during the prevalence of these storms—many times impracticable for several days. This source of annoyance cannot be overcome by any means known under the present system of telegraphing.

In the dry deserts of the Great Basin, both east and west of Salt Lake, the wire has been known to work for miles without interruption, while partially imbedded in the sand. The heat of the sun absorbs all moisture from the sand and renders it a non-conductor.

We thus find a very peculiar combination of obstacles—especially on the eastern division. In the month of June, for example, the weather at Salt Lake may be clear and warm, while the Waschita mountains, lying to the east, are covered with snow. It may be raining heavily at Fort Bridger, snowing at South Pass, clear at Fort Laramie, storming and raining along the Platte, and so on to Chicago. But it is worthy of note that when the lightning is so terrific at one station as to cause the operators to leave their instruments in alarm, the operators on either side are frequently able to continue their communications, the electric current passing entirely through the storm without any material interruption. Salt Lake communicated with stations far east of the Rocky mountains, when at South Pass the operators were effectually cut off.

In the vicinity of South Pass the operators are sometimes "snowed in" for months at a time. All communication with the outer world, save by telegraph, is completely cut off. A more isolated life than these poor fellows lead can scarcely be conceived. Around them as far as the eye can reach the mountains and plains are covered with snow. All traces of human life are obliterated. The station-houses are covered up, high over the roofs, and it is only by cutting a way out and keeping it clear that the occupants save themselves from being buried alive.

One of these stations is situated within a short distance of a point to which travellers in future ages will probably make pilgrimages, as the Mahometans now do to Mecca. It is the heart of the North American continent, from which flow the great arteries of commerce. Within a distance of 200 yards lie the sources of the Missouri and the Colorado. Here is the true line of division between the Atlantic and the Pacific slopes. On the one side an insignificant spring bursts from the earth. Gathering contributions from every cañon and ravine as it flows, it forms in time the Sweetwater river, which, after a long and turbulent career, empties into the Platte, the great river of the plains. From the Platte the Missouri takes up the current and rolls it onward till it swells into the majestic torrent of the Mississippi. The Gulf of Mexico receives the tribute. Up north, into the Arctic regions flows the Gulf Stream, which in turn pays tribute to the shores of Norway and Iceland. Who knows but the Indian deity of the Rocky mountains holds converse with the old Scandinavian god Thor, sending him letters of bunch-grass and drift-wood, while in return he receives from the winds, or through the flood-gates of heaven ashes from the Jokuls of Iceland? The idea is not altogether without foundation, but cannot in our present state of knowledge be turned to any useful telegraphic purpose.

On the other side, 200 yards distant, rise the Pacific springs, which form the source of the Green river. From Green river swells the great Colorado, the Red river of the desert; which, after a long and thirsty career through burning sands and cheerless wastes, cutting in twain the grim mountains of the Black cañon, receives in its bosom the Gila, or Swiftwaters of Arizona. Freighted with the red and golden sands of a great interior wilderness, where the Apache and the Navajo and kindred tribes of wild men still roam, it sweeps onward till lost in the seething waters of the Gulf of California.

What a magnificent point of observation for the prophetic eye of a poet. Looking to the east or to the west the new world, with its various races of inhabitants, its scenery, its commerce, its future, lies before him. Starting at this little group of springs, he could write a thousand volumes and leave "ample room and verge enough" for a thousand more, on the great future of this vast continent, where "no pent up Utica contracts our powers."

But the operators are generally practical men. In seasons of great severity they sometimes run short of food, and then they have a hard time. It becomes a simple question of life or death; starvation staring them in the face, and nothing around them but cheerless wastes of snow. To such perfection, however, have the company reached their system of operations at the present day, that instances of prolonged suffering rarely occur. The stations are supplied with abundant provisions for the winter, and with all the apparatus necessary for repairing the line. It is only in cases of Indian depredations or some casualty against which no human ingenuity can provide, that the employés can suffer for the means of subsistence. As a rule they are comfortably lodged in stockades or block-houses, well armed with rifles and revolvers, provided with horses for travelling to and fro along the line; and a wagon at each repair station to carry poles, wire, and implements, so that they are not so badly off as might be supposed. Isolation from the society of their fellow-beings is the most unpleasant feature in their calling; but even that has its advantages. They have abundant time for study and reflection, and can save a good part of their wages.

On the approach to the summit of the Sierra Nevada, it becomes necessary to increase the number of stations in consequence of the frequent interruptions to which the line is subject from falling timber, snow-storms and other causes. During the winter and spring months the storms are often so violent as to break down the poles for miles; and when the snows melt, floods and freshets are a prolific source of trouble. Even the dry season gives battle in the shape of extensive fires which sometimes rage through the forest, for weeks at a time, consuming all before them. In addition to these natural obstacles, which are formidable enough in themselves, the cupidity of man is too often cast in the balance against legitimate enterprise. Many apparent accidents to the line have been ingeniously contrived by speculators in Washoe stocks, for the purpose of gaining some dishonest advantage. Fortunately the sagacity and energy of the Telegraph Company have nearly precluded the possibility of cutting off communication for a sufficient length of time to afford facilities of this kind. It is their interest as well as their duty to preserve uninterrupted communication for the benefit of the public at large. With this view, stations are established at intervals of 8 or 10 miles all across the Sierras. One or two men are placed at each of these stations, with horses ready to go out at any time on either side In winter, during severe snow-storms, these horses are saddled ready for use, so that the employés whose duty it is to repair the line can proceed to the break without delay. When the difficulty is too great to be immediately remedied by connection of the wires, the despatches are carried to the first station beyond, and there repeated for transmission to their point of destination. It sometimes happens, during seasons of extraordinary severity, that the line is broken down 20 or 30 times in a single day and at as many different points. This is a busy time for the operators. They must be constantly on the alert, availing themselves of every possible resource that ingenuity can devise. It is not merely a mechanical office, as many suppose. Not only must the operator be skilled in the ordinary details of his profession, but he must have the head to devise, and the hand to execute in the various unforeseen difficulties which are constantly occurring. He must be able to act as well as direct—to repair by extraordinary where ordinary means are not at hand. With such men feats are performed almost every day during the winter of which the public have but little conception. A citizen of San Francisco telegraphs to his correspondent in Virginia City. In six hours, let us say, he receives a response. "How is this," he exclaims, "allowing full time each way for transmission, delivery, and probable delay, I should have had this answer at least four hours ago?" He is dissatisfied with the tardiness of electricity, or the operators, or both. He does not know, and probably would not believe it if told, that his message passed through ten or a dozen breaks on the line; that it was carried over several gaps on horseback, through raging floods, or blinding snow-storms; that dangers were encountered and hardships experienced in its transmission from which most men would shrink, unless they found their compensation in something beyond a monthly salary.

The falling of trees across the line is a source of great inconvenience in densely wooded countries. Although the wire is not always broken, the insulation is apt to be destroyed or affected, and thus communication cut off or rendered imperfect. Where the poles are far apart and the wires slack, several trees may lie across the line within a distance of eight or ten miles and still not break the wire. In these cases it becomes as tense as a piano string and gives forth a musical answer to the slightest vibration. The repairer usually exercises his discretion in adopting one of the two alternatives left, either to cut the wire or the tree. Mr. Shaffner mentions the case of an employé—an Irishman, it is presumed—who stood over the wire while he cut a tree that lay across it. Relieved of the pressure that bore it down, the wire suddenly righted itself, tossing the man about 10 feet in the air. His astonishment may be imagined, but scarcely described.

The construction of the overland telegraph, under difficulties so numerous and so formidable, was one of the great triumphs of the present age. When we consider the vast extent of desert country traversed, the scarcity of material, the vicissitudes of the climate, and the hostile character of the Indian tribes inhabiting the wild regions through which it was necessary to pass, the consummation of this enterprise is an event of which the American people may be justly proud. No achievement of ancient or modern times surpasses it in the magnitude of the interests involved both to commerce and to civilization. It was the first grand practicable demonstration of the feasibility of a system by which the remotest parts of the earth may be brought into direct and instantaneous communication, and thus the bonds of sympathy and interest strengthened between the various races of mankind.

In anticipation of the difficulties likely to arise between the Company and the public without an explicit understanding of the relations existing between them, Mr. Carpentier, while acting as president, devoted special attention to the formation of a code of laws and regulations by which they should be mutually governed and the interests of each protected. Among the laws devised by him and passed by the legislature of California, the most important, and that which most intimately concerns the public, is the act of April 18, 1862. This act introduces a new feature in the business of telegraphing, a feature not only novel in its conception and application, but of incalculable importance to the civilized world—the legalization of messages transmitted by telegraph in their relation to instruments and acts of law.

Appropriate provision is made to secure the public against dishonesty and fraud on the part of the operators and other employés. Penalties are imposed for divulging the contents of messages, changing the sense or meaning, knowingly sending false or forged messages, appropriating information to private uses, wilfully neglecting to send messages, or postponing or sending them out of order. Also, against fraud by any person whatsoever who may open seals of messages addressed to any other person, read despatches by means of any machine or contrivance, bribe telegraph operators to divulge the contents of messages, damage the line, or otherwise attempt to cut off communication. But the great feature of the law is that contracts by telegraph are deemed to be contracts in writing, and the signatures thereto are valid in law. Notice by telegraph is actual notice. Power of attorney or other instrument in writing, duly acknowledged and certified so as to be entitled to record, may, together with certificate of acknowledgment, be sent by telegraph, and the telegraphic copy or duplicate has *prima facie* the same effect in all respects as the original. Checks, due bills, promissory notes, bills of exchange, and all orders and agreements for payment or delivery of money or other thing of value may be made or drawn by telegraph, with full force and effect as if written. Persons indicted on oath for, or accused of, any public offence, may be arrested and imprisoned upon warrant issued by any competent officer, properly indorsed and directed to such officer as may be legally authorized to make the arrest. Writs or orders in civil suits or proceedings may also be transmitted in the same way. All these provisions are carefully guarded so as to avoid any infringement upon individual rights, while they tend materially to promote the public convenience and welfare.

A novel feature in this law is that the marriage ceremony may be performed without regard to distance.

Upon the passage of this important act by the California legislature, Mr. Carpentier proceeded to secure the passage of similar acts in the neighboring States and Territories. On the 17th of October, 1862, the legislature of Oregon passed an act embracing substantially the provisions of the law of California; this was followed by a similar act of the territorial assembly of Utah, passed January 16, 1863. As the State of California, always in the lead, was the first to make a practicable movement towards the construction of the Pacific railroad, the overland mail route, and the overland telegraph, so it has been the first to introduce this imporant feature in the laws governing the telegraph system. None of the Atlantic States, I believe, have yet adopted it, but they will doubtless come to it in time.

A very general misapprehension prevails in the Atlantic States in reference to the frequent errors and interruptions which have attended the working of the overland telegraph since it went into operation. The inconvenience to which the public have been subjected has been patiently borne, until patience has almost ceased to be a virtue. The facts of the case are that east of Salt lake, within the past four years, Indian disturbances have been a prolific source of trouble. The stations have been attacked, the line broken down, the operators murdered, and all communication cut off, day after day, week after week, yet California is compelled to bear a share of the blame. Without attempting to cast any censure upon the eastern division, which doubtless has done all in its power to prevent these interruptions, it has been the good fortune of the California divison, with the exception of a single outbreak at Ruby valley in 1864, to have had no difficulty with the Indians.

A marked difference exists between the character of the Indian tribes east and west of Salt lake. The Arrapahoes, Navajos, Apaches, and Sioux are powerful, mischievous, and warlike; the Shoshones, Bannocks, Pi-Utes, and other western tribes are poor and less able to cope with the whites. I refer to the fact as showing a prolific cause of failure on the eastern side to which the western division is not subject.

In reference to the operations of the division between Salt Lake City and San Francisco, there is not, I believe, a line of equal length in any part of the world upon which so few errors or interruptions have occurred. The system of checks adopted is so rigid that it is scarcely possible for an error to pass through the office at San Francisco. When there is doubt in regard to a word the operator causes it to be repeated from the Salt Lake office; if still the same and evidently an error, he causes it to be repeated back from the office in the Atlantic States where it originated. In the vast number of messages transmitted between Salt lake and San Francisco nearly every error that occurred has been traced back to the other side.

The greatest trouble hitherto in the working of the California division has been experienced in the Sierra Nevada mountains. This is now almost entirely obviated. The company have constructed four separate and distinct lines from Sacramento to Carson: one by the Dutch Flat route and three via Placerville, each of which is in full operation. It is scarcely possible for any combination of circumstances to result in the interruption of communication upon all these lines at the same time.

A new and substantial line has been built between San Francisco and Omaha, following the travelled stage route, making the second line across the continent. This was commenced as an opposition line by the United States Telegraph Company, but after completion between San Francisco and Salt lake, was purchased and finished from Salt lake to Omaha by the Western Union Telegraph Company.

The Western Union Telegraph Company, having purchased a controlling interest in the California Overland Telegraph Company lines, in June last took a lease of the lines of that company, and all are now worked under the name of the former company as their Pacific division. The lines of this division constitute all the wires west of Salt lake, from Los Angeles to a point in British Columbia 750 miles north of New Westminster, on Frazer river. This extends to near the boundary line of our Russian possessions.

A new line has been constructed by the Western Union Company from Salt Lake to Helena, in Montana, via Virginia City, Montana, between 500 and 600 miles in length.

Brigham Young has built a line some 400 miles in length, connecting the northern and southern settlements of the Mormons in Utah.

Telegraphic Connections—Table of distances.

	Miles.
San Francisco to San Mateo	20
San Mateo to Redwood	8
Redwood to Santa Clara	21
Santa Clara to San José	3
San José to Centreville	16
Centreville to San Leandro	18
San Leandro to Oakland	8
Oakland to Martinez	24
Martinez to Benicia	4
Benicia to Suisun	22
Suisun to Sacramento	45
Sacramento to Nicolaus	26
Nicolaus to Marysville	16
Marysville to Timbuctoo	17
Timbuctoo to Grass Valley	19
Grass Valley to Nevada	4
Nevada to North San Juan	18
North San Juan to Camptonville	8
Camptonville to Forest City	26
Forest City to Downieville	8
Marysville to Oriville	28
Oriville to Chico	26
Chico to Tehama	26
Tehama to Red Bluffs	12
Red Bluffs to Shasta	40
Shasta to Trinity Centre	45
Trinity Centre to Callahans	25
Callahans to Rough and Ready	11
Rough and Ready to Fort Jones	11
Fort Jones to Yreka	18
Yreka to Mountain House	40
Mountain House to Jacksonville	22
Jacksonville to Grave Creek	34
Grave Creek to Cañonville	34
Cañonville to Roseburg	27
Roseburg to Oakland, O	18
Oakland to Eugene City	58
Eugene City to Corvallis	40
Corvallis to Albany	10
Albany to Salem	24

Table of distances—Continued.

	Miles.
Salem to Oregon City	38
Oregon City to Portland	13
Portland to Vancouvers	7
Vancouvers to Monticello	40
Monticello to Drews	30
Drews to Olympia	52
Olympia to Steilacoom	22
Steilacoom to Seattle	60
Seattle to Pt. Elliot	35
Pt. Elliot to Tualalup	17
Tualalup to Swinomish	35
Swinomish to Sehome	37
Sehome to Semiahnoa	28
Semiahnoa to New Westminster	25
Sacramento to Folsom	22
Folsom to Latrobe	17
Latrobe to Shingle Springs	8
Shingle Springs to El Dorado	5
El Dorado to Placerville	6
Placerville to Sportsman's Hall	12
Sportsman's to Sugar Loaf	22
Sugar Loaf to Strawberry	12
Strawberry to Yanks	13
Yank's Station to Fridays	12
Fridays to Genoa	12
Genoa to Carson	16
Carson to Dayton	..
Dayton to Silver City	5
Virginia to Williamsburg	131
Williamsburg to Unionville	14
Unionville to Star City	12
Yank's Station to Glenbrook	17
Glenbrook to Carson	14
Carson to Ophir	13
Ophir to Washoe	3
Washoe to Virginia	12
Genoa to Wellington's	40
Wellington's to Aurora	50
Genoa to Markleeville	24
Markleeville to Monitor	7
Monitor to Silver Mountain	7
San José to Warm Springs	14
Warm Springs to Stockton	56
Stockton to Sacramento	45
San Francisco to Fort Point	5
Fort Point to San Rafael	21
San Rafael to Petaluma	24
Petaluma to Sonoma	12
Sonoma to Napa	12
Napa to Suisun	20
Sacramento to Newcastle	32
Newcastle to Auburn	4
Auburn to Colfax	19
Colfax to Grass Valley	11
Grass Valley to Nevada	4

	Miles.
Nevada to Dutch Flat	16
Dutch Flat to Donnor Lake	40
Donnor Lake to Steamboat Springs	46
Steamboat to Virginia	12
Petaluma to Santa Rosa	17
Santa Rosa to Healdsburg	15
Benicia to Vallejo	7
Vallejo to Napa	16
Napa to Calistoga	26
Sacramento to Auburn	36
Auburn to Coloma	14
Coloma to Placerville	9
Coloma to Georgetown	9
Georgetown to Todd's Valley	8
Todd's Valley to Forest Hill	3
Forest Hill to Yankee Jim's	3
Yankee Jim's to Iowa Hill	10
Iowa Hill to Dutch Flat	10
San Andreas to Copperopolis	15
Folsom to Latrobe	14
Latrobe to Drytown	14
Drytown to Sutter's Creek	5
Sutter's Creek to Jackson	3
Jackson to Mokolumne Hill	5
Mokolumne Hill to San Andreas	9
San Andreas to Murphy's	16
Murphy's to Columbia	12
Columbia to Sonora	7
San José to Gilroy	30
Gilroy to San Juan, S	12
San Juan, S., to Kingston	130
Kingston to Visalia	25
Visalia to Fort Tejon	125
Fort Tejon to Los Angeles	110
San Juan, south, to Watsonville	..
Watsonville to Santa Cruz	..
Santa Cruz to Monterey	..
OVERLAND.	
Carson to Dayton	13
Dayton to Fort Churchill	22
Fort Churchill to West Gate	69
West Gate to Austin	69
Austin to Grubb's Wells	51
Grubb's Wells to Ruby Valley	62
Ruby Valley to Egan	42
Egan to Deep Creek	74
Deep Creek to Fish Springs	52
Fish Springs to Fort Crittenden	99
Fort Crittenden to Salt Lake	43
Swinomish to Fidalgo island	15
Fidalgo island to San Juan island	12
San Juan island to Victoria, V. I.	20

ARIZONA.

SECTION I.

GENERAL FEATURES OF THE COUNTRY.

To be understood and appreciated, Arizona must be taken as a whole. Those who know it only as "the Gadsden purchase," those who have no knowledge of more than the Colorado river district, or who are only familiar with the central and northern regions, cannot form a correct idea of its resources and capabilities.

The general lines of the Territory are thus defined in the organic act approved February 24, 1863:

> All that part of the present Territory of New Mexico situate west of a line running due south from the point where the southwest corner of the Territory of Colorado joins the northern boundary of the Territory of New Mexico to the southern boundary line of said Territory of New Mexico.

In other words, all of New Mexico, as formerly existing, between the 109th degree of longitude and the California line, embracing 120,912 square miles, or 77,383,680 acres, a district three times as large as the State of New York.

The mountain ranges are a prolongation of those which, southward in Sonora, Chihuahua, and Durango, have yielded large quantities of the precious ore, and which, northward in Nevada, are attracting the attention of the world with their wealth. The general direction of the mountains and quartz veins is northwest and southeast, and there are numerous parallel ranges which form long valleys in the same direction.

The Territory is divided into many mining districts, but as these are liable to be changed at any time, the mineral regions will be defined under three grand natural divisions, viz: "Southern Arizona," "The Colorado River," and "Central Arizona," referring within these districts to the various streams upon which, or near to which, the placers or lodes are located, as affording the most definite description for permanent reference that can be given.

SECTION II.

SOUTHERN ARIZONA.

This part of Arizona, known as the Gadsden purchase, was the earliest occupied by the Americans, and is still the best known. Until the beginning of the war it was the favorite overland mail route to the Pacific, and it is still considered the easiest stage route across the continent. Its mountains are nearly all mineral-bearing, and silver lodes near to the Sonora line have been to some extent worked.

The principal towns of southern Arizona are Tucson, on the line of the overland mail route, and Tubac, 52 miles south. Both have long been in existence, and are situated upon the Santa Cruz river, which, rising in Sonora, runs nearly directly north until it reaches the Gila river, near the Maricopa wells. The distances from Tubac, which may be considered in the heart of the mineral region of southern Arizona, are, by the usually travelled roads, as follows: San Francisco, 1,074 miles; San Diego, 510 miles; Fort Yuma, 330 miles; El Paso, 389 miles; St. Louis, 1,770 miles. Towns in Sonora, Mexico—Santa Cruz, 54 miles; Magdalena, 51 miles; Altar, 95 miles; Hermossillo, capital of Sonora, 229 miles; Guaymas, port of entry of Sonora, 329 miles; Libertad, on the Gulf of California, 180 miles.

The ores of silver found in southern Arizona are argentiferous galena, native silver, auriferous sulphuret of silver, black sulphuret of silver, sulphate of silver, sulphate of iron combined. The gangue is usually quartz or feldspar. The ores of copper are usually the sulphurets, principally gray.

Nearly all the silver and copper lodes show traces of gold, and placers have been found at many points, but have not proved sufficiently extensive to attract much attention.

While, owing to Indian disturbances and the consequent high prices, and other serious impediments to mining operations, most of the lodes in southern Arizona are now temporarily abandoned, no one familiar with them doubts that some of them are valuable, and must eventually be worked with profit.

THE COLORADO MINE.—This mine, otherwise known as the Heintzelman, (in honor of General Heintzelman, United States army, who was among the first of the American owners,) is situated on the south side of the Cerro Colorado mountain, about 22 miles west of Tubac by way of Sopori, and eight miles north of Arivaca. The lode runs nearly north and south, and may average 22 inches in thickness. It is about 2,000 feet in length, and is distinct and separate from the porphyry rock on both sides. Mr. Sam. F. Butterworth, who, on behalf of the owners in New York, examined the mine in the winter of 1863–'64, reported as follows:

> The principal ore in the depth is silver-copper glance—containing an average of six per cent. of silver; this is accompanied by argentiferous gray copper ore, which averages two per cent. of silver. These minerals are very unequally distributed through the quartz; their presence in greater or less quantity determines the value of the ore; at the present level they constitute about seven per cent. of the ore fit for reduction, making its value about $120 per ton; at a higher level the ore contained fully 30 per cent. of these minerals.

Guido Küstel, who reported upon the property at the same time, says:

> The main shaft, 6 feet by 12, well timbered, and furnished with substantial ladders, is placed on the east side of the lode, which pitching east, changes the inclination in the deph, so that the shaft, which was calculated to strike the lode at 160 feet below the surface, may not reach it before 400 or 500 feet depth. The distance from the shaft to the vein, below the present work, is less than 30 feet.

There are other shafts, and some tunnelling and drifting, and the depth of actual working is about 120 feet. Mr. Küstel further says:

> The characteristic feature of this mine is the rich ore which shows everywhere. The principal ore in the depth is silver-copper glance, containing from 2 to 10 per cent. of silver, accompanied by argentiferous gray-copper ore, with from one to three per cent. of silver. On the more or less abundant appearance of these two minerals in the quartz, the richness of the ore chiefly depends. The distribution in the quartz is very unequal, sometimes in small particles, and sometimes more massive. This last, representing the first class, when selected was formerly obtained; about 30 per cent. of the whole mass of ore is fit for reduction; but at the present level only five to eight per cent., so that over the average of the ore cannot be estimated much over $100 per ton. This estimation refers to the vicinity of the main shaft for about 200 feet in length. North and south of this part, the quartz prevails, making the ore poorer.

Near the Cerro Colorado mine, and upon the same property, are other promising lodes. Mr. Küstel refers to one of them:

> In Arivaca, a few hundred yards east from the lead mine, a quartz lode, "Mina Blanca," is found, (discovered long ago,) in which rich silver ore occurs. This vein was opened only about nine feet deep, and never further prospected. Mr. Higgings is informed of this mine. It is very probable that more good veins will be discovered yet in the neighborhood of the Colorado mine, such as do not crop out. Till now not much attention has been paid to this kind of prospecting. The best mines in Santa Rita are those lately discovered, of which no outcropping was to be seen. This was also the case with the Heintzelman lode.

Regarding wood, water, and the process for working the ores, he says:

> For about 20 miles round Cerro Colorado there is very little wood, but sufficient to supply a limited steam engine for hoisting the ore. Water is also scarce. The shaft at 100 feet depth gave as much water as was required for about 100 men and animals.

> If the same quality of ore be found deeper in the Colorado mine, and this doubtless will be the case, the amalgamation in pans by way of roasting cannot be recommended on account of the copper which would enter the amalgam to from 600 to 800 per cent. The smelting of the first-class ore cannot be introduced for want of lead ores. The richest ore was melted formerly with from 200 to 300 per cent. of lead ore. It was procured from the lead mine in Arivaca. This mine, however, did not yield as much ore as required. Some lead ore was obtained from the Patagonia mine, under conditions that 85 per cent. of the silver contained in the lead ore had to be returned to the Patagonia mine free of cost.
>
> In regard to the scarcity of wood or fuel generally, whatever location may be selected, it appears that for the Colorado ores and circumstances, two methods of reduction should be adopted: First, amalgamation in barrels; and second, amalgamation by patio.

The following is a report made to the Sonora Exploring and Mining Company regarding the Cerro Colorado mine in 1861, by Colonel Talcott:

Report showing the quantity and value of silver ore yielded by the Heintzelman mine, how disposed of, and where that on hand is situated on the 1st *of July,* 1860.

	Pounds.
Sold and taken by purchasers to Sonora	3,880
Sent by the company to San Francisco	44,037
Sent by the company to Cincinnati	1,400
Smelted by the company	18,991
Reduced by amalgamation at the Arivaca works of the company	586,700
Total sold and reduced	655,008
Remaining at Cerro Colorado	129,500
On hand at Arivaca	443,700
Total ore on hand	573,200
Total product of the mine	1,228,208

The 655,008 pounds sold and reduced yielded the company	$45,010 28
Allow for ore on hand $90 per ton	25,794 00
Value of ore raised	70,804 28

General Heintzelman stated in a letter from the mine, dated 1858, that all the ore smelted to that date yielded $920 per ton. Herman Ehrenberg, civil and mining engineer, wrote from Tubac in 1859 that 75 tons smelted or reduced in various ways yielded $41,180 in silver, or an average of $549 per ton.

The Arivaca ranch, upon which the Cerro Colorado mine is situated, comprises 17,000 acres, and was famous in the days of the Jesuit missions. It is thus described in the report of the engineer who first surveyed it:

> The Arivaca has much beautiful meadow land, fine pasture on the low surrounding hills for thousands of cattle; live oak grows in the gulches, mesquite on the hills, and on the lower ends of the streams it is thickly lined for five or six miles with groves of cottonwood, ash, walnut, and other useful woods for farming and mining purposes, in sufficient quantities to answer all demands.

On and near the ranch a number of silver lodes have been taken up. Upon the Euriquetta some expensive machinery was erected several years since, but like that upon the Heintzelman mine it is now idle. The lodes are probably too small to be profitably worked until mining can be conducted at less expense.

SANTA RITA MINES.—These mines are located in the Santa Rita mountains, some 10 miles east of Tubac, and 50 miles south of Tucson. Mr. Wrightson, agent of the company owning most of them, thus referred to their characteristics in a report made in 1859:

> The ores of the Santa Rita mines are suited to both smelting and amalgamation. The smelting ores are those in which there is a large admixture of lead or very rich sulphuret of silver and copper. The amalgamation ores are those where the salts of silver and copper predominate.

The Crystal and the Encarnacion mines yield smelting ores. The Bustillo, the Cazador, the Ojero, and the Fuller mines yield ores which by assortment can be treated by both processes. The Salero yields amalgamation ore.

Raphael Pumpelly, mining engineer, made an elaborate report in 1861, from which the following extracts are taken:

The veins of the southern spur of the Santa Rita occur in a feldspathic porphyry, characterized by the absence of quartz, and presence of hornblende. They are not isolated occurrences, but, as is usual with true fissure veins, appear in groups. Indeed, the entire range of hills, from the point of the Salero mountain to the Santa Rita peak, is an extensive network of lodes. They differ but little in the character of their outcrops, usually more or less porous quartz, blackened with oxide of manganese, or reddened with that of iron. Frequently green, blue, and yellow colorings betray the decomposition products of our argentiferous fahl ores. There is no reason for doubting that the great mass of these are silver leads, while at the same time there is the weighty argument of analogy in favor of such a supposition.

The different leads present a remarkable uniformity of character. Having nearly all the same general direction, they also possess the same combination of minerals. Many of them have been prospected by small shafts, but there are hundreds apparently equally good that remain intact.

Gila or Ojera Vein.—Direction north 69° east, south 71° west; inclination 81°. More work has been accomplished on this than on any other belonging to the company. The old Ojero and the Gila shafts, two frontons at the latter, and a small prospecting shaft, have been opened on it. In the beginning of 1860 good ore was discovered in the outcrop, and on excavating, a rich deposit of galena and fahl ore was found.

The Salero has a different direction from any known vein of the district. Its course being about north 35° east, its continuation northeast must intersect that of the Gila. It is well defined, and presents every indication of a good vein. It possesses a shaft 69 feet deep, admirably equipped, and timbered in a very substantial manner.

The Crystal has a direction of north 85° east, and is one of the best defined leads that have been opened upon. A shaft 34 feet deep and 24 feet of fronton have been accomplished. The ore is abundant, and being almost massive sulphuret of lead, will be of great value in smelting. It is associated with copper pyrites and zinc blende. Although the last named mineral is an unwished for ingredient, occasioning much trouble in the furnaces, still this difficulty can be to a great extent overcome by a careful separation.

The low yield of silver in the crystal undoubtedly arises from the absence of argentiferous fahl ores, but I do not doubt that these will make their appearance, and with them an increase in the amount of silver. Should the ore continue as abundant as it is at present, or should there be an increase in the lead ores of other mines, it is probable that the reduction works would yield an excess of lead and litharge over the amount needed for their own use.

The Buenaventura is one of the most interesting leads belonging to the company. A remarkable characteristic of this lead is the great facility with which the silver in its minerals can be extracted. Of this the following experiments will give an idea. A trial was made in the patio, and from what I can learn, from about 400 pounds of average ore, 20 ounces of silver were obtained. From another made on good ore, (10 pounds,) 1.5 ounce was the result, being at the rate of 336 ounces to the ton.

The ores of the Santa Rita mines fall into two classes, lead ores and fahl ores, considering them mineralogically; or into three, when classified according to the metallurgical process best suited to them in this country.

1. Smelting ores; galena and such fahl ores as are too rich in silver to be subjected to other processes.
2. Refractory amalgamation ores, containing a certain percentage of lead, and requiring to be roasted before reduction, whether this be accomplished in the patio, the barrel, or the salt process.
3. Ores containing rich fahl ore, native silver, sulphuret of silver, and other simple or complex salts of this metal, with little or no lead, needing no roasting for the patio, and no magistral, or but very little.

Under the first two heads come the products of all the mines excepting those of the Buenaventura and Mascasa, which fall almost entirely into the last division.

Nearly all of the ores will require a mechanical preparation before they can be submitted to the different processes. The more massive lead and fahl ores, with a small percentage of quartz, need simply a separation by hand. The amalgamation ores require crushing and grinding, and the majority of the smelting ores demand both crushing and washing to free them from useless gangue.

The old ranch of Tomacacori, two and a half miles south of Tubac, is claimed by the company owning most of the Santa Rita mines. It was the seat of a Jesuit mission, and the ruins of a splendid church edifice are still to be seen upon it. Water for working the mines is found at this ranch on the Santa Cruz, and at one or two points on the Sonoita.

Sopori.—The ranch of Sopori, a noted property, lies south of the mission of San Xavier del Bac, nine miles south of Tucson, where is a costly church edifice erected nearly a hundred years since, and remarkable for its architectural symmetry and beauty. The Sopori ranch, through which the Santa Cruz river runs, has been thus described:

> Besides the bottom lands on the estate, which are partially wooded, a large portion is covered with a dense forest, chiefly mesquit or locust, (*Algarobia grandulosa*,) while along the margin of the river are found cottonwood, sycamore, ash, and walnut trees; but the mesquit is the timber *par excellence*, on account of the many uses to which it may be applied.
>
> In the mountains, on the extreme eastern portion of the estate, is pine timber. Between the timber lands and the mountains are large tracts of grazing lands, unsurpassed in the Territory for their excellence. The arable portions, before referred to, though limited, are adapted to the cultivation of wheat, corn, barley, and other cereals; and to the fruits and vegetables of the southern States. On the grazing lands innumerable herds of horned cattle, horses, mules, and sheep were formerly raised, when the great haciendas and missions were in a flourishing state.

The Sopori Silver Mine, upon the ranch named, has been somewhat developed by a New England company. In 1859, Frederick Brunckow, geologist and mining engineer, made the annexed reply to a letter of inquiry:

> In answer to your inquiries about the mine and ranch of Sopori, in the Territory of Arizona, I have to say, that I am familiar with said mine and ranch, from a three years' residence in the vicinity as chief engineer of the Sonora Exploring and Mining Company, at Cerro Colorado.
>
> I have made several assays of the ore from the Sopori mine and found them to yield from 10 to 15 marcs per cargo. The ore can be treated successfully by amalgamation, with the barrel process. The mine is well located, being near wood, water, and grass, the three necessary elements to its successful development.
>
> There is a small quantity of agricultural land in the vicinity, and an immense range of excellent pasturage. On the Santa Cruz river, near by, great forests of mesquit timber prevail. The roads are the best natural roads in the world.
>
> There may be other mines in the vicinity of Sopori. I have examined some outcrops in the vicinity, which proved to be argentiferous galena. Gold has been washed in this vicinity during the rainy season, and is to be found in the Tenajas mountains.
>
> Pine timber for building purposes can be obtained from the Santa Rita mountains, on the east of the Santa Cruz valley.
>
> Sopori is one of the best locations in Arizona for mining, trading, farming, and stock raising.

Mowry Mines.—This well-known mining property has perhaps been more continuously and successfully worked than any upon the Sonora border. Some $200,000 is said to have been expended in the purchase of the property, the erection of reduction works, houses for laborers, and everything necessary for an extensive and permanent establishment, including steam engine and mill. The district is finely timbered and watered, and proverbially healthful. Twenty-five tons of the ore were sent to Europe in 1862. The result, (says Mr. Mowry,) was an offer of £50 sterling per ton for the ore as it ran, properly cleaned. Some bars of lead and silver from the reduction works sold in England at $200 per ton, and many have been reduced at the mines, in an English cupel furnace, to supply silver for the payment of current expenses.*

F. Biertu, metallurgist and mining engineer, wrote a report upon these mines in February, 1861, from which the following extracts are taken:

> Instead of finding, as I expected, barren mountains, as at Washoe and Mono, I gazed on beautiful landscapes and a country covered with trees of different kinds, with fertile lands perfectly watered. True it is that the nearest neighbors, the Apaches, are far from being even equal to the Patagonians; but this, it seemed to me, could not be a reason for giving to such a beautiful spot, which in spring must be covered with flowers, so savage a name.
>
> * * * * *
>
> The property, containing about 500 acres of land, is situated 10 miles from parallel 32° 20′

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* All the reports made upon this mine are, in my opinion, to some extent exaggerated. I visited it in 1864, and found that the average of ores ranged at $35 to $40 per ton. The lode averages about four feet in thickness. The mine has never paid expenses, but might be made profitable under judicious and economical management.—J. R. B.

> north latitude, which forms the limit between Arizona and Mexico, 20 miles from Fort Buchanan, 14 from the town of Santa Cruz, in Sonora, and at an elevation of 6,160 feet from the level of the sea; and a good road, 280 miles in length, and which, with a little repair, might be made excellent, places it in direct communication with Guaymas. By this route freight from San Francisco to the mine does not go beyond five cents per pound. The mine is situated on the last hills forming the eastern slope of the Sierra de Santa Cruz, and is bounded on the northeast by extensive plains covered by the mesquit and oak trees, which reach the line of Sonora, whose elevated mountains rise in the horizon. Between these plains and the mine is to be seen the Sierra Espuela, called also Wachuka mountains.
>
> The road leading to the mine from Fort Buchanan crosses a range of hills and mountains completely covered with oak, pine, sycamore, poplar, willow, and hazlenut. The land and the hills around the mine are covered with green oak, cedar, pine, and manzanitas. The whole country abounds with rabbits, quails, and wild turkeys. It is not a rare occurrence to meet droves of deer and antelope, numbering from 25 to 30.
>
> * * * * * * * *
>
> The principal lode of the Patagonia mine is composed principally of argentiferous galena, and runs south 85° east. Its thickness, which increases as it dips in the earth—now 83 feet in depth—is of about three feet. Three small veins, excessively rich, cross each other in the main vein, all running in different directions. The size of these small veins varies from 10 to 19 inches. Other veins, whose outcroppings are visible on the top of the hill, and which run in a parallel direction at a great distance, will, according to all probabilities, be met with as the working of the mine proceeds. The galena of the principal vein contains a small quantity of copper and arsenic. It seemed to me that I detected appearances of zinc, but I had no means to ascertain the fact. An assay of the different ores has given results varying from $80 to $706 in silver per ton, and up to 62 per cent. of lead. Their reduction is of the utmost facility.

Guido Küstel sent the following condensed report upon the Mowry mine from San Francisco to New York by telegraph, in April, 1864:

> The lode, which is over 14 feet wide, runs east and west, between limestone and granite-like porphyry. It consists of sulphurets and carbonates of lead in manganese, often pure, containing iron, frequently in large chambers. Its great advantage is the presence of iron, manganese, lime, and lead, so that the necessary fluxes are in the ore in abundance. The greatest depth worked is 180 feet. There are four galleries.
>
> The present style of furnaces and system of purification are more like waste than rational working. Nevertheless, these furnaces paid all expenses, with 120 men employed.
>
> The present expense of working six tons per day is $15 per ton. There are many thousand tons of rock out in front of the main shaft, half of which is fit for melting after very simple concentration.
>
> Wood is abundant. Live oak costs $1 75 a cord.
>
> With furnaces four feet square and ten feet high, and with proper treatment, more silver at less expense could be extracted. The best ore produces $350, the poorest $50 per ton. But, even reckoning mining and reduction at $20 per ton, facts and calculations show that the net profits of one day's work of 20 tons will be $1,280.

A statement from Mr. Mowry, later in 1864, says the lode has

> Much increased in width and richness at the great depth of over 200 feet. The vein often spreads out into chambers of pure ore of great size, no gangue appearing between the side walls. Two peons have taken out 10 tons of rich ore in one day's work.

OLIVE MINE.—Half a mile west of the Mowry mines is the Olive lode, of argentiferous galena. Three shafts of 30 feet each have been sunk in it, and the lode shows a width of 14 inches. The ore worked to this time has given from $50 to $100 per ton.

SAN ANTONIO MINE.—This mine is distant about six miles southwest of the Mowry mines. It was discovered in 1862, and has been worked to some extent. Its ores are described as carbonates and sulphides of lead, the latter occurring in segregations.

> The veins in which these ores are found is composed of decomposed garnet, followed along some portions of its line of strike by limestone, bounded by a country formation of feldspathic and granetic porphyry. This vein varies on the surface from a few feet to 12 or 14 feet in width.

The Empire, the Eagle, the French, and the La Esperanza silver lodes, in the same vicinity, have been sufficiently opened to demonstrate the existence of argentiferous galena in quantities and of a grade that may eventually pay.

The Gualota lode, four miles west of the Mowry mines, is a lode varying from one to six feet in width on the surface. At the bottom of a shaft of 60 feet there is a vein of metal three feet wide. The ore is chiefly sulphurets of silver, and there are traces of gold.

The Fresnal lodes are about 60 miles west of Tubac, in the Baboquivori range. The country is very rough and broken. At places wood, water, and grass may be had, though generally scarce. The ores are sulphurets of silver, and argentiferous galena, black and brownish ores. The chief lode, called the Prieta or Ajax, has bold croppings, and is at places 10 feet in width. The lode has been traced for six miles. Twenty tons of the surface ore, reduced by the Patio process, gave $30 to the ton the poorest, and $45 the best. The size of this vein, (although it is not so rich as others already discovered,) with some facilities for working, will probably make it valuable. Three other veins have been worked in the Fresnal district, (so called from an old town now abandoned,) viz: the Colorado, and two not definitely named. Ore from the Colorado yielded $75 to the ton.

The Cababi Mines are in a district some 75 miles northwest of Tubac, in the Cababi mountaims. The veins are not large, but are moderately rich. The ores are of silver in sulphurets, (amalgamating,) and have thus far been reduced by the Patio process only. The Picacho mine, sometimes called the Padreas mine, has a vein about three feet in width. It has been worked for many years, and the average yield of the ores has been about $80. It is estimated that the present owner has extracted $50,000. Mexican labor only has beeen used. The Tajo, the Providencia, the Tiger, the Cobriza, the Cokespa, and the Bahia mines, in the immediate vicinity of the Picacho, are well spoken of. Some 50 tons of the Cobriza ore, (selected,) sent to Europe via Guaymas, and reduced by the best process, brought $550 per ton in silver and copper. Eight tons of selected ore from the Picacho, sent at the same time, yielded $1,200 to the ton. Mr. Pumpelly says of the Cababi lodes:

> The veins which I observed occur in a quartziferous porphyry and in an amygdaloid rock. This latter has a brown compact base, containing numerous acicular crystals of triclinic feldspar, and calcareous spar in impregnations and small threads. Cavities, some filled with quartz and others with delessite, are frequent.
>
> A great number of veins of quartz and barytes occur in these two formations, the latter seeming to prefer the amygdaloid rock. One vein of barytes, containing a "bonanza" of sulphuret of silver, was found and worked by the Mexicans, and several specimens of heavy spar associated with silver glance from various localities were shown me.

The Fresnal and Cababi mines are in the country of the Papago Indians, a branch of the Pimas, who have always been friendly to the whites. Hence operations upon the mines have not necessarily been interrupted. Mexican and Indian labor may be had at from $15 to $30 per month, and provisions may be brought from Sonora at low rates, flour seldom costing over four cents per pound. While water is scarce, there is sufficient for mining, and in the shafts of the Picacho lode there is now so much that pumps are needed.

At Quijota, west of Cababi, are gold placers (dry washings) long worked by the Papagoes, and now worked by them and at times by Mexicans, with considerable profit. Large pieces of fine gold have been extracted, and the gold generally is coarse.

Sierriti Mines.—These mines are in the Sierriti mountains, about 30 miles northwest of Tubac. They are of argentiferous galena. Work has been done upon the Benton, Belcher, and other lodes. There is an old gold placer at the west end of the mountains, long worked by Mexicans. In the vicinity is an abundance of water and oak timber, and some gold placers worked before the discovery of gold in California.

Ajo Mines.—These copper mines, sometimes called the Arizona mines, are situated northwest of the Cababi mines about 60 miles, and 40 miles south of the Gila river. The ores are principally of red oxide, malachite of copper, and gray sulphurets. A number of veins have been opened, and the mines were steadily worked for three years. The ore was carried to Fort Yuma and thence shipped to San Francisco, to Swansea, and to Boston. A shipment of 30 tons of the red oxide ore sent to Swansea sold for $360 per ton, and is said to have been the richest copper ore of the class ever received there. Work was suspended upon these mines chiefly because of the lack of water on the desert road to Fort Yuma.

SANTA ROSA MINES.—About 50 miles west of Tucson, near the road from Cababi to Maricopa Wells, are some copper lodes, with indications similar to those of the Ajo mines.

APACHE PASS.—South of this well-known pass, on the overland mail route to New Mexico, a number of lodes have been located by soldiers and others, but little work has been done.

MINES NEAR TUCSON.—In the vicinity of Tucson lodes are not so numerous as about Tubac and the Sonora line, but a number have been taken up.

LEE'S MINE, 12 miles due west from the town, shows a vein two and a half feet wide, of silver sulphurets and galena. Some of the ore worked in an arrastra has given a return of $150 per ton, and considerable work has been done upon the mine. Five hundred pounds of ore lately smelted yielded 90 ounces of silver.

LA PAR MINE, near Lee's mine,, is of a similar character and has a shaft of about 100 feet. About 25 tons of the ore have been smelted.

SPANGLER MINE, some six or eight miles southwest of Tucson, is a copper lode upon which some work has been done.

VICTORIA LODE is about 16 miles southwest from Tucson. Ten tons of the ore (copper) were lately taken out, and a part of the same has been shipped to San Francisco via Guaymas for a working test. The vein is some 10 feet in width. Four tests of the ore in small quantities have returned a yield of 45, 71¼, 72½, and 74¾ per cent.

SAN PEDRO LODES.—The district of the San Pedro river is chiefly noted for its fine agricultural lands, but several promising lodes have been found in it. It lies east from Tucson some 25 miles. Mr. Pumpelly describes the ores as tetrahedite and massive copper glance, containing copper pyrites, with quartz and barytes for gangue from the San Pedro vein, and galena with iron pyrites from the St. Paul vein. The San Pedro river furnishes an abundance of water for all purposes.

At the Cañon d'Oro, on one of the roads from Tucson to the San Pedro, are gold placers which are occasionally worked, and seldom without affording fair wages. There are evidences of work done upon them in years past.

MARICOPA LODE.—This lode, sometimes called Gray's mine, situated about 70 miles north of Tucson and four miles south of the Gila river, is considered one of the best copper deposits in southern Arizona. Mr. Gray thus described the vein in a general report, made in 1860:

> The formation of the district is primitive, chiefly granite and sienite, with metamorphic and sedimentary rocks, and injected dikes of trap and quartz.
>
> The lode was traced and measured 1,600 feet, having a width of from 8 to 12 feet plainly marked by its walls and .out-cropping ore. The veinstone is quartz, with seams of argentiferous copper ore, at the surface a few inches wide, but which at six feet down appear nearly solid, covering the greater part of the lode.
>
> The copper glance and gray ore predominate, though at top the carbonates and silicates were intermixed. A branch vein shows itself near the place of greatest development. Here it traverses an elongated hill, intersecting it lengthwise, and protruding above the surface from one end of the hill to the other, a distance of 700 feet. The hill is 60 to 125 feet higher than the valleys and ravines surrounding it, and slopes for half a mile in the direction of the lode to the west, when the ground descends northward towards the Gila at a rate of 250 feet to the mile.
>
> The course of the lode is very regular, north 84¾° east, or 5¼° north of true east, and 5¼° south of true west. The dip is to the north, and about 75° from the horizon, very nearly vertical as far as could be observed

> The elevation of the Maricopa mine, determined by me with a fine cistern barometer, is 3,378 feet above the level of the sea, and 1,497 feet higher than our camp established on the Gila river six miles off, selected as a good site for smelting works.

W. R. Hopkins, civil engineer, in connection with the same report, speaks as follows:

> * * * We have traced the copper lode by distinct pieces of heavy ore for 1,600 feet, about east and west; also, three other veins. The lode appears to be from 8 to 12 feet wide on the surface.
>
> The shaft we have commenced is on the main lode, and on a hill that rises from 60 to 100 feet above the surrounding gulleys. It is now seven feet square and six feet deep. The ore is increasing in richness, and the veins widening. The vein containing the copper glance, specimens of which you will receive, is now 20 inches wide, and occupies the south side of the lode. Next to this comes gray and green ores and the red oxide of copper. The lode is now occupied with the ore, so that nearly all that is thrown out goes into the pile to be smelted.
>
> The dip of the lode is now slightly to the north, and we suppose that it will run into another lode 25 feet north of it, and form a wider bed of ore than we now find.
>
> We would express to you our confidence in the extreme richness of the mine, both from our own observation and the opinion of experienced miners throughout this section of country.
>
> We find the water-power on the river abundant. Mesquit is in sufficient quantities to furnish charcoal, which is of the best quality.

Frederick Brunckow, assayer and mining engineer, made a report in January, 1860, upon some selected specimens from this mine, from which this extract is taken:

> The specimens consisted of the outcrop ore of a powerful vein, and bear the unmistakable signs of a true vein. * * As commonly by all outcrop ore, so here carbonates and silicates make their appearance, while the main body of the vein, to some extent below the surface probably, will consist in general of gray sulphuret of copper and other ores which already in large quantities appear upon the surface. * * I divided the ores into different classes, and assayed them accordingly.
>
> 1. Fahl ore, (Tennantit,) mixed with carbonate, contained to the ton 50 per cent. copper and 104 ounces silver.
> 2. Gray sulphuret containing to the ton 60 per cent. copper and 93 ounces of silver.
> 3. Silicate of copper containing 20 to 25 per cent. copper, and 20 to 25 ounces of silver to the ton.
> 4. Carbonate of copper containing 25 to 50 per cent. copper and only a trace of silver; as carbonates and silicates are secondary formation, a large yield of silver could not be expected.
>
> The ore of this vein would be the cheapest and quickest way to reduce in a blast furnace, and run into copper ingots, which could be shipped, and afterwards be stripped of their silver. Iron crushers for breaking the ore, as well as the necessary blast, could be driven by water-power, of which there is at the Rio Gilo any abundance.

General remarks on southern Arizona.—The foregoing reference to the principal mining localities in southern Arizona will show that the country is pre-eminently mineral bearing. In most places there is a tolerable supply of mesquit timber, but water is scarce. The grazing is generally excellent. A great need of southern Arizona is a port upon the Gulf of California, and it has long been the ardent hope of the people that either Guaymas or Libertad would be secured. While the roads are for the most part good, the distance from Fort Yuma, the nearest American port at present, is so great as to involve large expense in the transportation of machinery and such supplies as are not produced in the country.

Enough has been done to show that some of the lodes, if not remarkably rich, are sufficiently so to pay well when they can be worked at a reasonable outlay, and as the Apaches are overcome, and the agricultural lands are safely cultivated, mining operations will probably be renewed.

It is a well-authenticated fact that until the uprising of the Apaches, (about 1780,) many of the silver mines of that part of northern Sonora, now constituting southern Arizona, were worked with remunerative results.

Should a railroad from the Rio Grande, or from the Gulf of California, be extended over any one of the easy routes to southern Arizona, the country would be made an attractive mineral region, and would soon be well populated. The principal streams are the Santa Cruz, the Sonoita, the San Pedro, and the Gila.

SECTION III.

COLORADO RIVER.

The valley of this great river, "the Mississippi of the Pacific," may justly be considered one of the natural divisions of Arizona. Ascending the river from its mouth it is a distance of 150 miles to Fort Yuma, where the mineral district may be said to begin. Opposite to the fort, on the Arizona side, is the town of Arizona City. The Gila road to Tucson, and across the Territory to New Mexico, begins at this place, and the supplies for the military of southern Arizona are forwarded from here, coming from San Francisco via the Gulf of California.

Up the Gila, some 20 miles from the Colorado, gold placers were discovered in 1858, and caused some excitement. A traveller passing at that time says he saw $20 washed out of eight shovelsfull of dirt, and this in the rudest manner by an unpracticed hand. The diggings are in the sand-hills half a mile or more from the river, too far to carry water by hand, and as by dry washing but $1 or $2 a day can be made, they are now for the most part abandoned. Occasionally a strike is made by Indians or Mexicans, and $20 to $30 secured in a day. Old residents of the Colorado and Gila mining districts give it as their opinion that with water conducted to the placers they would pay well. A company organized in 1866 for this purpose sent some machinery to Gila City, but subsequently gave up the enterprise.

The first mining district of note on the Colorado is some 40 miles above Arizona City by the river, and known as the Eureka district. The ores are chiefly argentiferous galena, containing from 20 to 30 per cent. of silver. There is also a show of gold. The lodes are in the mountain ranges, and situated at from 1 to 20 miles east from the river banks. They may be reached by trails. Generally travel is difficult in that region, owing to the rugged nature of the country. But few of the lodes taken up in the first excitement (1862) have been developed. Of those upon which work has been performed the Buena Vista promises well. The width of the lode in the main shaft (which is 60 feet deep) is about five feet. Some of the ore submitted to a working test gave a yield of $60 in silver to the ton. The Bronze, the Margarita, and the Vernon lodes yield ore of the same class and value. The country rock is granite and slate; the silver veins are in pink and white quartz. Copper indications are numerous, and it is supposed that deposits of that ore exist here as well as further up the river.

Silver District, on the Colorado, north of the Eureka, has some well-defined veins capped with what the miners call "dry bone," containing considerable zinc. The district has been but little prospected. Most of the lodes located are from three to four miles from the river. Upon one a shaft was sunk to the depth of 25 feet before reaching metal, when a good quality of silver and lead ore was discovered.

Castle Dome, 50 miles above Arizona City, is a well-known mining district, so called from an isolated mountain bearing a close resemblance to a dome. The lodes are in a range of mountains from 15 to 30 miles back of the river, but, as in the Eureka district, they are not very easy of access, and water is exceedingly scarce. A number of lodes have been claimed, and several companies organized in San Francisco for their development. Those opened are from a foot to five feet in width, and well defined.

Professor Blake states that the ores of Castle Dome are argentiferous galena, in a vein-stone of fluor spar, and that they contain 30 to 40 ounces of silver to the ton.

Mr. Sage, one of the principal owners in this district, furnishes an estimate of what he believes the true value of the ores to be in San Francisco, and what the expense will be provided the mines can be made to produce regularly a large quantity of ore:

Price of 60 per cent. ores per ton		$50 00
Castle Dome ores are 75 ounces of lead		12 50
Add 75 ounces of silver per ton		75 00
Giving for value of ton of ore in silver and lead		137 50
Deduct freight to San Francisco	$15 00	
Deduct carting to the river	10 00	
Deduct mining and sacking	10 00	
		35 00
Leaving a profit per ton of		102 50

Mr. Gird, another owner, values the ores at 60 per cent. worth $40 in silver to the ton; making—

The value of a ton of ore		$90 00
He allows for mining and sacking	$12 00	
Carting to the Colorado river	15 00	
Freight thence to San Francisco	18 00	
		45 00
Leaving a profit per ton of		45 00

The bottoms and ravines furnish cottonwood, mesquit, and ironwood, but not in sufficient quantities to supply fuel for reduction works upon a large scale, and hence, as most of the Colorado river ores are such as require a smelting process, it will probably be found most profitable to ship them to San Francisco. Lately a price has been offered in that city for lead ores from the Eureka and Castle Dome districts which is sufficient to warrant their shipment even at the present rates of transportation.

In the WEAVER DISTRICT, next above the Castle Dome district, the silver lodes are much of the same character. Those of copper are quite promising. Of these the Colorado has a fair reputation. It is thus described by Mr. Herman Ehrenberg, a good authority:

> This mine is located on the east bank of the Colorado river, in the Territory of Arizona, nine miles south of La Paz, and about eight miles east from the river. The outcroppings are very heavy, and may be traced for a mile by bands or isolated outbreaks of quartz matter stained with carbonates, intermixed with copper-glance. The Colorado appears more like a mighty interstratified deposit of gneiss and metamorphic slates in which it occurs, forced to the surface by an eruptive mass of rock that breaks forth west of the croppings. Future developments may prove this appearance to be deceptive, and that at a greater depth the vein will have a greater dip, becoming more vertical, and, in place of following the stratification, break through them like a true fissure vein. It is immaterial, however, to which class of mineral deposits the Colorado belongs. If an interstratified deposit, or nearly horizontal vein, its great extent and width on the surface and the rich ores it contains speak extremely favorable for its becoming a lasting and extremely valuable mineral deposit. Many a great copper deposit, like those of Talhua and Mansfield, which have been worked for centuries, with immense success, are of a similar description, differing, perhaps, in the formation which encloses them being younger and less disturbed by eruptive forces. The ore already taken out may be divided into three qualities—the first should yield from 40 to 70 per cent. in copper, carrying with it a large quantity of silver; the next grade will give from 30 to 50 per cent. in copper alone; the third grade contains free gold ranging from $30 to $100 per ton.

A shipment of the Colorado ore was made to Richardson & Company, Swansea. Their return, dated January 17, 1867, gives a yield of 30¾ per cent. in copper, with 68 ounces of silver to the ton. They say they are ready to pay £50 sterling per ton for such ore.

The next district is that about the town of La Paz, and bears the same name. It was first explored in the Colorado gold excitement of 1862, and, indeed, little was known of the mineral resources of the Colorado valley until that year. Mr. A. McKey, member of the territorial legislature from La Paz, has furnished the annexed account of the discovery of the placers which caused the upbuilding of La Paz, now a place of considerable importance, and a favorite shipping point for goods for Central Arizona; Prescott, the capital of the Territory, being at a distance of less than 200 miles in the interior, and Wickenburg at a distance of but a little more than 100, over remarkably good roads:

Captain Pauline Weaver, and others, in the month of January, 1862, were trapping on the Colorado river, and at times would stray off into the mountains for the purpose of prospecting for gold. They had discovered what was then named and is still called "El Arollo de la Tenaja," which is about two miles north from El Campo Ferrá, and about seven miles east from La Paz. In this gulch they had discovered gold in small quantities, and had taken two or three dollars' worth out, which Captain Weaver kept in a goose-quill.

Soon after this discovery Weaver visited Fort Yuma and exhibited what gold he had. This evidence of the existence of a commodity so much sought for in this country convinced others that gold might be found in quantities by hunting for it. Don José M. Redondo having heard of the discovery, at once set out to visit the newly found "El Dorado" in company with several others. He arrived a few days afterward at the camp of Captain Weaver, who pointed out to him and his party the particular gulch from which he had taken the gold. After a short examination of this place the party set out in different directions to discover, if possible, something which would pay to work, and the extent of the placers. Within less than a mile from Weaver's camp, south, Redondo took a pan of dirt to prospect, and when he had dry-washed it, to the astonishment of himself and the party with him, he found that he had one "chispa" which weighed two ounces and one dollar, besides other small pieces. Others of his party found good prospects, but none of the company had come for anything more than to ascertain the truth or falsity of the reported glad tidings, and therefore were not prepared to remain and work for want of the necessary provisions and tools, but were compelled to return to La Laguna, a settlement some twenty miles above Fort Yuma, on the Arizona side of the Colorado. After their arrival at La Laguna, and report of what they had discovered, a party of 40 persons prepared to visit the new mines. After their arrival in the placers, about the middle of February, 1862, discoveries were made almost daily, until it was known that every gulch and ravine for twenty miles east and south was rich with gold. Ferrá Camp, Campo en Medio, American Camp, Los Chollos, La Plomosa, and many other smaller places, all had their rich diggings; but the discovery made by Juan Ferrá, of the Ferrá gulch, was, without doubt, the most valuable of any. Very soon the knowledge of these discoveries spread to Sonora and California, and people began to pour in from all points, and continued to come until they probably numbered fifteen hundred. This population was maintained to a greater or less extent until the spring of 1864, when the apparent exhaustion of the placers and the extreme high prices for provisions caused large numbers to leave. The discovery of the Weaver and Walker's diggings, in the year 1863, drew away many of the miners from these placers.

Of the yield of these placers, anything like an approximation to the average daily amount of what was taken out per man would only be guess-work. Hundreds of dollars per day to the man was common, and now and again a thousand or more per day. Don Juan Ferrá took one nugget from his claim which weighed 47 ounces and six dollars. Another party found a "chispa" weighing 27 ounces, and another one of 26 ounces. Many others found pieces of from one or two ounces up to 20, and yet it is contended that the greater proportion of the larger nuggets were never shown for fear of some evil spirits, who infested the mines at the time. It is the opinion of those most conversant with the first working of these placers that much the greater proportion of the gold taken out was in nuggets weighing from one dollar up to the size of the "chispas" above named. I have often heard it said of those days that "not even a Papago Indian would work for less than $10 per day."

As has been seen from the above, the gold was large, and generally clear of foreign substances. The largest piece (above mentioned) did not contain an apparent atom of quartz or any other base matter. The gold from the different camps varied a trifle in its worth at the mint in San Francisco, and brought from $17 50 to $19 50 per ounce. But all that was sold or taken here went for from $16 to $17 per ounce. Since the year 1864 until the present, there have been at various times many men at work in these placers, numbering in the winter months hundreds, but in the summer months not exceeding 75 or 100; and all seem to do sufficiently well not to be willing to work for the wages of the country, which are and have been for some time from $30 to $65 per month and found. No inconsiderable amount of gold comes in from these placers now weekly, and only a few days ago I saw, myself, a nugget which weighed $40, clear and pure from any foreign substance.

Some parties have lately come into these diggings with what is called concentrators or dry washers, which they have been working for a few weeks, and in conversation with Mr. Finkler (an owner of one of these machines) he told me that he could make $20 per day where he was at work, and pay three dollars per day for his hands, and that he only required four to work the machine. Should these machines prove a success these placers will soon be peopled again with industrious, prosperous miners. Of the total amount of gold taken from these mines, I am as much at a loss to say what it has been as I was to name the average daily wages of the first years, and as I might greatly differ from those who were among the first in these mines, I do not feel justified in setting up an opinion as against them; I shall, therefore, give the substance of the several opinions which I have obtained from those who were the pioneers of these placers. I have failed to find any one of them whose opinion is that less than $1,000,000 were taken from these diggings within the first year, and in all probability as much was taken out within the following years.

As might be supposed, the richness of these placers suggested the existence of valuable quartz lodes in the vicinity, and prospecting began in 1863. The result was the location of a number of gold, silver and copper veins within an area of 30 miles about La Paz. Of these several have been opened, and the ores well tested.

Constantia Mine.—A gold mine 12 miles east of La Paz has a shaft of 75 feet, and some 20 tons of the ore worked by arrastras yielded $30 to $50 per ton. The vein is five feet wide in a granite formation and regular. The Las Posas is a similar vein.

Conquest Mine.—This is a gold mine, otherwise known as the Ravena mine. It is situated east of La Paz, some six miles, and has been well prospected. A number of shafts and tunnels have been opened, and the vein is found to be well defined and promising. The width is from 3 to 20 feet. Some silver is found in the ore which is free from sulphurets. Gangs of men are now employed, as they have been for several years, in preparing this mine for working upon a large scale, and its owner, Mr. Ravena, is confident that he has a valuable property. He has already, it is said, been offered $100,000.

Cruc Mine.—This lode is also of gold-bearing quartz, with a mixture of galena in the ore. A shaft 50 feet deep has been sunk.

Picacho Mine.—At a point some 30 miles east from La Paz, on the road to Wickenburg, a number of silver-bearing lodes were opened in 1863 and 1864. Much work was done upon the Picacho, and about 300 tons of ore were extracted from the shafts and tunnels, which amounted to some 600 feet in extent. For some cause or other the ore was not worked. The ore is of argentiferous galena, and the vein shows a width of about three feet five inches.

Peach Bloom Mine.—A shaft of 80 feet has been sunk upon the lode which adjoins the Picacho, and is of a similar class.

The **Hughes**, the **American Pioneer**, the **Scotty**, and the **Salazan** silver lodes in the same vicinity are generally of the same class, but for various reasons have not yet been much worked. Good pay ore in carbonates and chlorides has been taken from the latter, but no permanent vein yet found.

The **Apache Chief** copper lode, near the foregoing, is one of the most remarkable in Arizona, and at one time attracted considerable attention in San Francisco. The ore is found in deposits rather than in a regular vein, but the location is too far from navigation to make mining profitable at present. The country about La Paz is barren of wood saving mesquit and ironwood in the gulches and ravines, and water is not abundant, although it might possibly be had at any point between La Paz and Wickenburg by sinking artesian wells. A company holding a charter for a toll road to Wickenburg and Prescott have proposed to sink several such, but have as yet taken no action.

Ascending the Colorado towards Williams Fork, the mountains, nearly all show signs of metal-bearing. Perhaps the most striking and extensive group of copper veins yet discovered is in the Harcuvar chain of mountains, at a distance of 35 miles east of the river, and 55 miles northeast of La Paz, and a little north of the La Paz and Wickenburg road, before referred to.

Herman Ehrenberg, who was among the first to examine the lodes upon the Colorado, as he was those in southern Arizona, and who was noted for his cautious language, made a lengthy report upon the Harcuvar district, of which the annexed is a synopsis:

The group embraces 18 lodes, making an aggregate of 51,200 lineal feet. Shafts have been sunk which demonstrate that they are not only large but permanent veins. The rocks of the country are granite gneiss, fractured at right angles to the plain or arrangement of stratification. The fissures are nearly perpendicular, and vary in width from 5 to 15 feet. The vein mass consists of calcareous spar, tinctured green by the mixture of talc in small quantities It is distinctly separated from the connecting rock by a narrow selvage of a ferruginous substance, colored by hydrated oxide of iron. The sheets of ore are compact and continuous, the mass of the gangue being found near one of the walls, both of the true walls of the different cuts having been reached in only a few instances. The several cuts show the same general bold iron-stained croppings, the same broad fissures, the same surface ores, similar dip, and nearly parallel bearing or strike.

On the CUNNINGHAM lode the shaft has been sunk to the depth of 107 feet. The metallic part of this vein varies in width from four to six feet, the width gradually increasing with the depth. The ore in sinking assumes an undecomposed and characteristic appearance, *i. e.* sulphurets and pyrites. The vein has a dip of nearly 80° north-northeast, bearing or striking northwest, and is singularly regular, being traceable a long distance on the surface.

The QUA-SHA-QUA-MAH, another of the leads embraced in the group, has been sunk upon to the depth of 48 feet; it is a much larger vein than the Cunningham and has yielded some good ore. All the other leads have been opened by small shafts or cuts, and nearly all show the same bold croppings, similar dip and strike, and the same general character of ores. It is unquestionably one of the most promising groups of copper mines in Arizona. Assorted ores taken from these leads have been shipped to Swansea, and worked 37½ per cent. Assays made range from 30 to 70 per cent. These high-grade ores can be easily mined.

WILLIAMS FORK.—Some 70 miles north of La Paz, Williams Fork, or, as it was originally named, "Bill Williams Fork," after a well known trapper and explorer, enters the Colorado from the east. It is the first tributary worthy of note north of the Gila, and has its rise in the mountain ranges between Wickenburg and Prescott; the streams known as Kirkland creek and Date creek being its head-waters.

The Williams Fork district is now the best known copper region in Arizona. The country for a number of miles on each side of the creek abounds in scattered croppings and masses or bunches of copper ore. It is contended by some that there are several clearly defined copper lodes. A recent writer thus refers to their characteristics:

> The containing rock is of trapean character, and geologically speaking, comparatively recent, probably belonging to the early tertiary or eocene era. These copper veins are, from the present state of knowledge and observation, supposed to be composed entirely of fissure veins, or infiltrated deposits from the general impregnation of the containing rock, their materials having made their way by plutonic forces through the trapean rocks, and their accompanying formations. The theory of the formation of this district is against a synclinal plutonic base, unlike the California middle copper belt, because the whole of the containing rock is the same. Its geognostic position, however, is, as far as authoritative geology is concerned, sufficiently true of a real vein formation. But one of the best evidences of the value of the copper deposits of that district is that they are massive, solid, and regular, so far as developed, whilst in the deposits the least infiltration is impregnated with carbonates. The outside gossan is usually of specular or magnetic iron, which is invariably found adjacent on the surface. Such is the character of the richest copper mines the world over.

The Planet Company was organized in California in 1864; the company owns five claims as follows: Planet, 2,700 feet; Ashley, 2,100 feet; Wash, 2,100 feet; Sentinel, 2,100 feet; and Mountain Chief, 1,800 feet. To this time no work has been done upon the Sentinel and Mountain Chief more than that required by the laws of the district, in order to hold them. The Ashley claim has been so far developed as to show evidences of a ledge of copper ore about 600 feet in length. Several cuts have been made developing indications of an average thickness in the ledge of about 10 feet. The character of the ore is malachite, assay 30 per cent. copper. Only about 25 tons have been mined from this claim. The Wash claim is the wash separating the Ashley and Planet claims. The Planet claim has been worked since the spring of 1865, and about 800 tons of ore have been taken out. The ore is of gray and red oxide, average assay 40 per cent. It has been sold in San Francisco at an average of $100 per ton.

The mines are located 12 miles from the Colorado, and within a quarter of a mile of Williams Fork. The cost of transporting ore to San Francisco was at first $60 per ton. It is now $28 per ton, and will probably soon be but $18 or $20. If the company could erect a warehouse at the mouth of the Colorado, and store the ore there until a cargo for a large vessel accumulated, it could be shipped from the mines to Boston or Swansea, at a total cost of not more than $25 per ton. Then 30 per cent. ore, of which there is a quantity in both the Ashley and Planet claims, could be profitably worked. Several other companies are engaged in working copper lodes at Williams Fork. Mr. Thompson, a practical and enterprising miner, superintendent of the Great Central Company, has erected furnaces for smelting the ore taken from the Eliza mine, and although he has had many obstacles to contend with, his experiment has not proved altogether unsuccessful. The Eliza is but 1,000 feet distant from the Planet It is thought by some to be upon the same vein, but this has not yet been demonstrated. According to a late report the company have two small furnaces running, turning out copper from 91 to 96 per cent. fine, which is being shipped to San Francisco. A large lot of this copper has been sold for 15 cents per pound, $300 per ton. The cost of delivering such copper is but a little over $100 per ton.

The ores of this mine are oxides and carbonates, very little or no iron or sulphur being present; hence the company is able to turn out at one smelting a very good article of copper. Some of this copper has been used by the brass foundries of San Francisco, who have pronounced it a very fair article for many commercial purposes, just as it comes from the furnace. Within less than two months they will have a larger furnace in operation, which they think will be able to turn out from three to five tons of copper per day.

The company own two parallel ledges of 3,000 feet each. Only one ledge has as yet been developed to any considerable extent. Upon this an incline has been sunk to the depth of 100 feet, at which point there are some indications of sulphurets coming in. At the depth of about 50 feet drifts have been run each way from the shaft about 100 feet, all the way in good ore; vein varying from five to seven feet thick. The shaft is also connected with the surface by a tunnel, through which the ore will be taken out. The outcrop of the vein has been stripped quite a distance, developing good ore all the way. The superintendent estimates that he has 5,000 tons of ore opened to sight, which will average a yield of 25 per cent. He has lately taken out some ore yielding 74 per cent.

MINERAL HILL, a locality near the Planet mine, has several of these so-called lodes, supposed to be valuable. The Springfield Company are now taking ore from the Orion; a furnace has been erected by Mr. Knowles. At Empire Flat, 10 miles south of Williams Fork, and three miles from the steamboat landing on the Colorado, the Challenge mine has been worked for more than a year, and about 500 tons of fair shipping mineral secured. The Kangaroo, the Bridal, and other copper veins promise well, and ore lately worked by an arrastra from a gold lode in this vicinity gave a return of $85 to the ton.

From Williams Fork to Fort Mohave, by the Colorado, is a distance of about 70 miles. Just about the fort, which was established long prior to the organization of the Territory, there are no lodes, but in the mountain ranges east, and north and east of Hardyville, a town nine miles higher up the river, are some districts already noted for their gold and silver mines.

THE SAN FRANCISCO DISTRICT is situated some 12 miles from Hardyville, in a northeasterly direction. A stream called Silver creek runs through the district from north to south. The features of the district, which is some 20 miles long and 10 miles wide, are thus given by a recent writer:

> The bold outcrop of quartz lodes stretching from east to west may be seen for a long distance. Conspicuous among these ledges is the Moss lode on the north, the Skinner and Parsons on the south. The aspect of these ledges is singularly wild and rugged, deviating seldom more than 4° or 5° from the east and west magnetic equators. There is another set of lodes much less numerous than the first, whose general direction is northwest and southeast, or more exactly north 20° west. These lodes, if prolonged, must obviously intersect some of the east and west lodes. They differ not only in their course and direction, but in their mineralogical construction. The first class, the east and west, are quartz lodes, characterized by the presence of feldspar and flourspar as the associate minerals. The second set of lodes may be called calcareous, being composed to a great extent of magnesian carbonate of lime, or dolomite. In some instances these have quartz linings and polished walls. The Virginia, Olive Oatman, and Buffalo are conspicuous examples of the calcareous lodes. A third class of lodes is observed in the San Francisco district, whose direction is northeast and southwest. This class is very small, not including more than three or four, named the Pride of Mexico, Trimuverate, Wright, and Morning Star. In general the lodes in the San Francisco district are remarkably vertical, rarely deviating more than 30° from the perpendicular, and their outcroppings are commonly very strong and well marked, forming in case of the upper lodes conspicuous features in the topography of the country.
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> The rocks of this district are exclusively porphyritic or volcanic. The porphyry consists for the most part of the feldspathic variety. The crystals of feldspar are implanted in a violet-colored mass, yielding, like most of the porphyries at Virginia City, at Esmeralda, Bodie, and in the Mojave desert, to atmospheric influences, crumbling into incoherent masses, or breaking away into acute and fantastic cliffs. The gigantic quartz lodes, known as the Moss and the Skinner, contain imbedded in their mass, especially at their surface, fragments of scoriaceous lavas, and present in general a burned and roasted appearance. On the Organ cañon of the Mojave there are extinct cones of volcanoes, whose streams of lava may be traced for eight or ten miles, standing with vertical basaltic walls 100 or 200 feet above the plain, capped with scoria, whose surface still speaks of the sluggish nature of the once molten mass.
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> The attention of the mineralogical observer is arrested by the similarity of the lodes in this region as compared with those of other districts, by the general absence of metallic sulphurets, and the carious or porous character so common in the outcroppings of quartz in most auriferous regions, and not unlike those seen in some portions of Nevada. This character of outcroppings of the quartz lodes in the San Francisco district is common to most outcroppings in the porphyritic or plutonic rocks of other mining districts in Arizona, as in the districts of El Dorado cañon and the Wauba Yuma.

Of the contents of the lodes the same writer has the following:

> The Moss, Skinner, and in general the larger lodes of the district, are characterized by the presence of an abundance of white feldspar, forming sometimes the mass of the vein; the quartz existing then as a subordinate vein in the feldsparic and porphyritic gangue. The mineral most characteristic of the east and west lodes in the San Francisco district, next to the quartz and feldspar, which form the great mass of the lodes, is flourspar, a mineral frequently seen elsewhere in the world as an associate in silver-bearing lodes—as, for example, in Frieburg in Saxony—but which is of rare occurrence in this country in a similar association.
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> This mineral is found abundantly in the Skinner lode, the Dayton, the Knickerbocker, and the Quackenbush, and has been observed in the Moss and several others. It is associated in them with free gold, horn silver sometimes in dodecahedra crystals and iron gossary. The outcroppings of the Moss lode form a most conspicuous feature in the landscape, seen standing up in bold crests from a long distance. This lode stretches in a continuous line for more than a mile, and is claimed for double that distance. It is distant north of Silver creek about two miles; its course is about west 5° north, nearly at right angles from the river, from which it is distant about five miles. On the surface the outcrop shows a width of about 50 feet, rising to the height of from 50 to 100 feet above the arroya, sinking at intervals to the surface; its height above the Colorado river is about 1.500 feet. It has a southerly dip of 14° to 20° away from the vertical. The vein material is composed of whitish compact feldspar and quartz porphyry, intersected by veins of dense red, often marbled quartz, rich in free gold. Included in this vast mass are numerous sets of feldspar, hornstone, and quartz veins, also masses of gray porphyry, tufaceous and vesicular lava.
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> The hanging wall of the Moss lode is an ash-gray, feldspathic porphyry, often intersected by thread-veins of quartz and hornstone, barren of metallic sulphurets, showing at the surface no clay wall, or fluccan, separating it from the vein. The absence of this character of permanent and well-defined lodes at the surface of the Moss ledge is in analogy with the character of many veins in Nevada, which, however, at a moderate depth acquire this feature, as the Allen shaft shows to be the fact for the south or hanging wall of the Moss

lode. The entire outcrop of this lode has a burnt-up, dried and hardened aspect, but is proven to be quite superficial by very moderate explorations.

The bullion obtained from this vein contains silver enough to give it a pale, yellow color; the gold appears in beautiful polished scales, the flat surface often embossed with crystalline lines. The precious metal is sometimes imbedded in a compact red jaspery quartz, presenting, when cut and polished, beautiful graphic goldstone. This rich gold-bearing mass of ferruginous quartz form the outcrop of this gigantic vein only at isolated points. These physical features bear great resemblance to that portion of the Comstock vein, which is still seen at Gold Hill, south of Virginia City, where similar rich deposits of low-grade gold were formed in the quartz outcrop, giving name to the town which has since sprung into such wonderful activity as the result of the development of the mines which have opened upon this remarkable silver vein. Assays of samples of the Moss vein show a value varying from $170 to several thousand dollars per ton of 2,000 pounds. Of the other lodes in this district, the Skinner, on the south side of Silver creek, is one of the most conspicuous, and, like the Moss, show bold outline of outcrop. This lode shows drusy quartz, both compact and cellular, and ferruginous with numerous cavities, out of which flourspar has been decomposed. Small traces of sulphide are seen at the surface, which is stained by black oxide of maganese, making portions of the outcrop quite black. This vein varies from 50 to 150 feet in thickness. Its walls are ash-colored, feldspathic porphyry, in places beautifully polished on the line of dip 70° north. The vein appears to be without a lining of clay, but like that which is so commonly seen in the outcrops of Nevada, that it is no proof of the absence of this important characteristic of a true vein at a moderate depth, assays of ores from this vein prove the presence of silver to the respective values of $25, $74, and $83 to the ton of 2,000 pounds. The Parsons, Hunst, and Leland are other gigantic lodes, south of the Skinner. The smaller lodes of this district seem to promise quicker returns for a less expenditure of money, such as the Caledonia and Dayton, a few hundred feet south of the Moss lode, and the Quackenbush and Knickerbocker, some distance south of the Skinner and Parsons. These veins are from three to ten feet in thickness, well defined, and showing at the surface all the characters of true metalliferous veins. Samples from these outcrops yielded in a mill from $40 to $250 per ton.

Mr. A. E. Davis, of Hardyville, has furnished some notes descriptive of the Moss, Parsons, and several other lodes in the San Francisco district, which are given with a slight condensation:

The Moss Lode was among the first discovered in this district, and is perhaps the best known. The vein is well defined for a distance of two miles. The rock is dark colored and iron stained, the country rock is porphyry, the hanging wall smooth and hard. Some remarkable specimens of gold ore have been taken from this lode. In blasting, in some instances, pieces have been torn out yellow with gold, and the face of the lode has shown streaks of the precious metal. It is not surprising that the owners have held their claims as high as $300 per foot. The gold is of a bright color, and usually found in layers as thin as paper, which makes it more showy than abundant; the lode, however, promises well. There are several shafts, and recently a tunnel 300 feet in length has pierced the vein at a depth of 150 feet, where the vein is wide, and considerable gold was found, but fine and scattered. The tunnel enters the vein at right angles, and after reaching it follows it west for 300 feet, where a shaft descends from the surface. All the rock taken out bears gold, and the vein, from a width of five feet at the surface, increases at the greatest depth reached.

A 10-stamp mill was erected at Hardyville a few months since, and about 250 tons of the ore have been worked, but the result is not announced. The cost of mining is $5 per ton; of hauling to the mill the same.

The Parsons Lode.—This lode runs east and west, and can be traced by neat wall of croppings for a distance of two and a half miles. The vein rock is chiefly a gray quartz, accompanied by flourspar. The country rock is blue and birds-eye porphyry. The lode is from 5 to 12 feet in width. There are several claims upon it, those best known being the Southern Cross and Queen of the Pacific. Upon the latter a tunnel of 210 feet in length, along the lode, has been cut.

Crossing, or rather running into, the Parsons lode at nearly right angles is a lode known as the Michigan. The vein is about three feet thick, and a few tons of the surface ore worked in an arrastra gave a yield of $70 to the ton in gold; the tailings since worked yielded $80 to the ton in silver.

What is now known as the Southern Cross, or Hardy mine, is a location of 1,800 feet on the Parsons lode and of 1,600 feet on the Michigan lode. The Parsons is probably the mother lode of the vicinity. Beginning at the eastern terminus of the Hardy location, at a large wash, the lode takes its course west over an eminence, say 400 feet higher than at the starting point, and this in a distance of about 1,000 feet. The lode is favorably situated for tunnelling, and several tunnels are already well advanced. A shaft between the two principal tunnels is now down some 80 feet, following the vein; it will need to be 200 feet deep in order to reach the depth of the tunnels. The shaft is five and a half feet wide, but it does not occupy the whole vein. One hundred tons of the ore taken during the past summer from this shaft and from other cuts, and worked in the Moss mill, gave a return of $18 to the ton, while the assays of the pulp from the battery gave about $35 to the ton. This experiment is not considered, owing to a want of proper facilities in the mill, an accurate test of what the ore will produce under proper working. The owner of the claim, Mr. Hardy, is pushing the tunnels and shafts forward, and is confident that he has a good mine. He has already expended $40,000 in opening it, and will soon erect a mill at Hardyville.

The Leland Lode, in this district, runs east and west, and is about five feet in width. The rock bears gold and silver, the former predominating. The gold is fine and evenly diffused through the rock. A tunnel 150 feet in length strikes the lode at the depth of 50 feet, where the quartz is as good as at the surface.

The Mitchell Lode runs east and west, with a slight dip to the north; has good walls, and the vein is from three to six feet in width, of quartz and flourspar. A vein of quartz of a bluish color, varying in width from one to two and a half feet, runs the whole traceable length of the lode, and prospects well in gold. For my own satisfaction (says Mr. Davis) I took from this vein 10 pounds of quartz, a fair sample, and pulverized it in a hand mortar, when, washing it in a pan, it yielded at the rate of $150 per ton in gold. But little work has been performed upon the lode, owing to a want of means and to Indian troubles.

THE SACRAMENTO DISTRICT.—Next to the San Francisco, the Sacramento is the best known of the districts adjacent to Fort Mohave and Hardyville. It is some 30 miles northeast of the latter place, and abounds in veins, several of which have been opened. This district is tolerably well watered, having three or four small running streams and a number of springs. The water is, with the exception of two or three springs, of an excellent character. Pine and cedar timber are abundant, and the whole district is rich in nutritious grasses, and arable lands are near at hand. The mines are chiefly of argentiferous galena, and show well in gold and silver. There are also some copper veins showing free gold. A correspondent has furnished the following list:

Neptune Lode.—This lode shows a vein seven feet wide, with walls of slate and granite. A shaft has been sunk to the depth of 150 feet. The ore shows both gold and silver.

Silver Hill Lode, argentiferous galena; a shaft 100 feet deep; vein four feet wide.

Alcran's Lode, gold and silver; shaft 65 feet deep; vein three feet wide.

Mohave Chief Lode, gold and silver; shaft 45 feet; vein six feet wide.

Antietam Lode, copper; shaft 40 feet; vein three feet wide, two feet of which is ore yielding from 40 to 80 per cent. There are also rich traces of gold and silver.

Blue Bell Lode, gold and silver; shaft 24 feet; vein two feet wide.

Darby Lode, gold and silver shaft 26 feet; vein two feet wide.

Daniel Webster Lode, gold and silver; two shafts 20 feet each; vein three feet wide.

Atlanta Lode, argentiferous galena; shaft 22 feet; vein three feet wide.

Union Lode, argentiferous galena; shaft 13 feet; vein eight feet wide, showing a mass of mineral.

THE WAUBA YUMA DISTRICT is upon the road to Prescott, and some 50 miles from the Colorado.

> Here (says a writer describing the district) seems to be an entire change in the geological formation; the porphyritic and volcanic rocks giving a place to metamorphic schists, gneiss, and granitic rocks abounding with numerous veins of quartz, and is accompanied by a corresponding change in the character and direction of the mineral veins Near the western margin of the Wauba Yuma district occurs a considerable vein of auriferous quartz, accompanied by ores of copper and sulphurets of iron. It is located in a high granitic mountain; it is called the "*Pride of the Pines*," and appears to be about 10 feet in width, possessing promising characteristics common to the auriferous lodes of the Sierra Nevada, and has the same northwest and southeast direction. Enormous dikes or roofs of quartz, and of course quartz ore, feldspathic granite, cut through the reddish gneissoid granite which forms the basement rock over a large part of the Wauba Yuma district. Upon these gigantic quartz ledges no exploration has been made, nor is there evidence of much metallic value in them.

There is some timber in this district, chiefly pine, oak, and walnut, and it is well supplied with water and grass.

The Pride of the Pines lode has a shaft 36 feet in depth, and shows a vein three feet wide, in which there is considerable free gold and some traces of silver.

The Ben Franklin lode has a shaft 22 feet deep, and shows a vein four feet wide, with gold and silver.

The El Bonito, McAnneny, Florence, McClellan, Mountain Lily, Rubicon, and *William M. Lent lodes* in this district are well spoken of, and a company has been formed in New York to develop them.

El Dorado cañon, upon the west bank of the Colorado, some 40 miles north of Hardyville, is the centre of a silver district, in which a number of lodes have been located and several of them worked. Two mills were erected several years since.

The Tchatticup lode is seven feet wide, well defined, and yields good ore. Four hundred tons crushed averaged $70 to the ton.

The Queen City, Indian Queen, and other lodes have a good reputation.

This part of Arizona has, by a vote of Congress, been set off to the State of Nevada, but its inhabitants protest against the change, and the legislature of Arizona has unanimously memorialized Congress to reconsider its vote.

GENERAL REMARKS ON THE COLORADO RIVER COUNTRY.—Although not well known until long after southern Arizona had been explored, and not yet fully prospected, the valley of the great Colorado is entitled to some consideration as a mining region. The temperature is much like that of southern Arizona, and the region is about as well wooded and watered. The timber is chiefly mesquite and iron wood, and found in the ravines and gulches. There is, also, considerable cottonwood along the Colorado and its tributaries, and for mining use and fuel the drift-wood annually swept down the Colorado furnishes an acceptable supply.

The agricultural lands of the Colorado region are less extensive than those of southern Arizona, but where they are found they are mellow and fertile. The Yuma, Mohave, and Chimahuevá Indians, friendly tribes, cultivate them with success, and gardens laid out near La Paz, Arizona City, Mohave, and Hardyville by the white settlers have produced abundantly. The broad plains lying between La Paz and Weaver and Wickenburg only need water to be made productive, and this it is thought can be supplied by artesian wells.

There are various opinions regarding the navigation of the Colorado. Small steamers have for some years delivered freight at La Paz and Hardyville, and many persons consider the latter place the practical head of navigation, but of late several trips have been made to Callville, and it is asserted that the river is navigable to that point. The difficulties and delays are serious obstacles, but it is thought they may be overcome. Callville is some 600 miles from the mouth of the Colorado, and the roads to Salt Lake City, a distance of about 400 miles, are easy and safe. It is believed that the river may be improved so as to render navigation to Callville practicable in a commercial point of view, especially when boats such as are used upon the upper Missouri, and upon the Tennessee and Cumberland rivers, are introduced. In the event of success, trade will be made one of large profit, not only securing the transportation of great quantities of silver and copper ores, but of supplies for all of Arizona north of the Gila, for Utah, and for parts of Montana. The merchants of San Francisco, conceding the importance of the river as a channel of trade, have lately held several meetings to encourage navigation, and to call general attention to the practicability of the same.

At a meeting of the merchants of San Francisco held September 27, 1867, G. W. Gilmore, esq., submitted the following report of observations upon the Colorado river, chiefly made during the trip of the steamer Esmeralda, Captain Rogers, in November, 1866:

> **PORT ISABEL TO FORT YUMA.**—For the whole of this distance the river runs through an open country, presenting on either side wide stretches of bottom lands, covered with vegetation and abundantly supplied with timber, mostly cottonwood, willow and mesquite. The Indians who live along the river cultivate the land to some extent, producing good crops of Indian corn, squashes, melons, beans, tomatoes, and other vegetables. Occasionally a little barley and wheat are planted, which always appear to yield well.
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> About 60 miles above Port Isabel, tule lands commence, extending along the river on either side for a distance of 20 or 25 miles, and back from the river to a great width—on the west shore said to be in places 20 or 30 miles in width. These tule lands are dry enough for cultivation, and hold out promise of great fertility. Above the tules the land is again higher, like that below, covered with vegetation and trees, and more or less cultivated by the Indians up to Fort Yuma.
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> For the whole of these 175 miles the river has a very crooked and winding course, averaging in width probably half a mile; and this average width, it may be here remarked, it retains for the entire distance up to Callville, varied from time to time by bars and bends, or by its passage through mountain cañons and rocky obstructions.
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> The tide ebbs and flows for 30 or 35 miles above Port Isabel in ordinary stages of the river, and for this distance on the flood tide salt water is found.
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> At the rise of water the river will perhaps, on the average between Fort Yuma and the mouth, be five to six feet above low water level—the rise lessening towards Port Isabel.
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> The channel, sometimes on one shore, sometimes on the other, has a width varying from one-eighth to one-third of a mile, and a depth of from four and a half to eight feet. The only obstructions of note in the entire distance to Fort Yuma are two sand-bars, which at times have not over two feet of water upon them, and are frequently, in low stages of water, consequently troublesome. It often happens that these bars are washed away and changed suddenly by the current. In one instance, during a single night, a bar with but two feet of water upon it disappeared, and 10 feet of water were found next day in its place.
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> **FORT YUMA TO LA PAZ.**—The river continues very crooked, having about the same average width and depth of channel. There are perhaps three bars which may be called bad in low water, though these are frequently cut away by the current so as to have plenty of water upon them.
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> At high stages of water great changes take place in the channel. The banks are of light-colored adobe soil; they were in some places during last season's unusually high water cut away for a mile directly into the land, changing the course of the river to that extent, but leaving a new channel quite equal to the old. This cutting occurs at bends of the river in the bottom lands, which, as below Fort Yuma, are covered with vegetation and timber; the trees of the varieties already named are suitable for fuel, and are of very rapid growth. It is found that upon new lands formed by the cuttings of the river cottonwood, willow, and mesquite trees will be produced in three years large enough to cut for fuel.
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> Fertile bottom lands extend with little interruption along the banks of the river from Fort Yuma to the Barriers—the first rapids on the river, situated about half-way to La Paz. Here a range of broken mountains approaches the river on either side, and its channel passes between high rocks, which contract it and give it a current more rapid and difficult to make head against than any other rapid on the river excepting the Roaring rapids. At the Barriers there are two channels. The one used at low water is about 100 feet wide at that stage, the current flowing through smooth, deep, and very rapid. The rapids are short, probably 500 yards, more or less. The other channel, used when the river is up, is wider and easier.
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> After passing the Barriers, the mesa, an elevated gravelly plateau, generally barren, nearly up to the river in many places, breaking the bottom lands, and forming the banks for spaces sometimes of half a mile, at others of two or three miles along its course. Occasionally the mesa will form one shore of the river for a mile or two, while on the other will be a fine open bot-

tom. This mesa, where it strikes the river, is usually 20 to 30 feet above the water. It is never overflowed, and during the mosquito season the Indians live upon it to avoid those insects, which are exceedingly troublesome upon the lower lands. All the way from Fort Yuma to La Paz the mesa can be seen from the river in the distance, bordering the bottom lands, though at times it seems to be 15 or 20 miles distant. The bottom lands prevail throughout the distance of 175 miles, probably covering two-thirds of the way. They are similar to those below Fort Yuma, as before mentioned, and are to some extent inhabited and cultivated by the Indians, whose villages are occasionally seen along the river shore. Trees are quite abundant for most of the distance, and plenty of fuel to be had. Fuel cut by the Indians is not very good, as they usually take only dead trees or driftwood, instead of cutting live trees and piling the wood to dry. Driftwood upon the lower river is mostly of the lighter woods that grow there; while upon the upper waters it is of wood having good substance for fuel.

Above the Barriers is the well-known rancho of William Rhodes, extending 16 miles along the east bank of the river. The land is cultivated to a small extent, and sustains large numbers of cattle which thrive remarkably well.

La Paz to Mohave Cañon.—The character of the river is a little changed in these 100 miles. It has a width of from one-eighth to one-third of a mile, and a depth ranging from four and a half to eight feet, with occasional bars having, say, 30 inches of water upon them. It is much less crooked than below. There is generally a good wide channel with a pretty rapid current, and occasionally a short bend which, at high water, will cause a powerful eddy, a little dangerous for a steamboat of insufficient power. There is, however, no broken water, and no dangerous rocks are to be found.

The valley described in the last section extends, with little change of character, up to Mohave cañon. About 30 miles above La Paz the Chimahueva mountains approach to within a couple of miles of the shores of the river, with a fine open country lying about their base. In these mountains are copper mines which promise to become very productive whenever work upon them, now suspended, shall be resumed. After passing Williams Fork, situated about 80 miles above La Paz, there is a distance of 18 or 20 miles to Mohave cañon, through which the river passes, cutting its way for eight or nine miles through a high range of mountains; flowing partly between immense precipices of rock, rising nearly perpendicular from its sides, and partly between masses of broken rocks and mountains. The channel, however, is of good width and depth, free from dangerous rocks, and with deep water close up to the rocky shores, against which a steamboat's guards will touch while the hull is in clear water, free from projecting points of rock. This feature is constantly to be observed upon the Colorado in places where it passes between shores of rock, and is a most favorable circumstance for steamboat navigation.

Mohave Cañon to Hardyville.—Above the cañon the valley again presents itself, differing little in character until reaching Fort Mohave, about 30 miles above. For this distance the bottom lands prevail, bordered in the distance by the mesa, which occasionally comes up and skirts the river for short distances and then again recedes, leaving long, wide stretches of low lands covered with vegetation, and producing the same timber as that found lower down the river. Upon the east side of the river a few Mohave Indians are scattered; on the west, a small number of the Chimahueva tribe. There is a great deal of fine farming land lying between the cañon and the fort, some of which is already occupied by Americans. Here was located the Philadelphia rancho, occupying several miles along the east side of the river. Of this rancho a large part has been washed away and lost by the cutting out of the river during the past two seasons.

After passing Fort Mohave the shores change. Low mesas, producing a little vegetation, form the banks upon both sides of the river, except when occasionally broken by small bottoms of good land, some of them occupied by a few Indians. Scarcely any timber is seen upon the river from the fort up to Cottonwood island. What little formerly grew upon this part of the river has been mostly cut off.

For the 60 miles from Mohave cañon to Hardyville there is nothing serious to impede navigation. The river is much straighter than in the lower parts, and has no sharp bends and no bad bars. In some places a strong current is encountered, but there is nothing to stop a steamboat. The average width of the river continues about half a mile. The channel in width and depth is about the same as that described in the lower part of the river.

Hardyville to Cottonwood Island.—The shores continue of low mesas on each side. There is very little timber to be seen. Here and there is a small opening of arable land, breaking the line of the mesa. A few Indians of the Mohave and Chimahueva tribes are found upon the banks. The country generally presents a poor and barren aspect, but in a few places upon the small bottoms farms might be cultivated. A trifling amount of firewood can yet be had upon this portion of the river.

For this distance the river may be said to be quite straight. Its bends are long and easy, and it offers every facility for navigation. The few bars found have sufficient water upon them even at low stages. Some places are to be passed where there is a quick current, but there is no obstruction to navigation until the head of Cottonwood island is reached. At this place there is a sand-bar upon which the depth of water frequently changes, and which is said might sometimes in low water prove troublesome. When the Esmeralda crossed it there were five feet of water upon it, and that at a low stage of the river. The river continues about half a mile in average width, and the channel about the same in depth and width as in the lower river—ranging say from four and one-half to eight feet deep in most places.

Cottonwood island, about 10 miles long by an average of about three miles wide, is a fine, level island, fertile and covered with grass, and having considerable timber. Claims are said to have been located upon the land, but it is yet unoccupied. On the main land on both sides of the river opposite Cottonwood island are fine bottom lands, with good grass.

A large quantity of driftwood of superior kind for fuel, composed mainly of pitch-pine and cedar, every year lodges at the head and along the sides of the island—sufficient, perhaps, alone, if taken care of, to furnish the fuel for years to steamboats passing on the Callville route. An immense quantity of this wood was upon the island, estimated at several thousand cords. The entire head of the island seemed to be formed of trunks of trees and sand washed in between them. The driftwood consists of trees, much broken up, of various sizes, not usually exceeding 14 inches in diameter.

COTTONWOOD ISLAND TO CALLVILLE.—In these 60 miles are found the following points of interest:

Round island, four miles above Cottonwood island.		
El Dorado cañon, five or six miles above Round island	10	miles.
The cave, five miles from El Dorado cañon	15	"
Roaring rapids, two or three miles above the cave	18	"
[Explorers' rock is six miles above Roaring rapids.]		
Black cañon, 20 miles above Roaring rapids	38	"
Callville, 20 or 22 miles above Black cañon	60	"

From Cottonwood island to Round island, (four miles,) there is nothing serious to impede navigation. The channel is good, though occasionally some "strong water" is met with.

At the point where El Dorado cañon empties into the Colorado, (five miles above Round island,) mountains and high broken lands commence, and continue to border the river until the Black cañon is passed, a distance of probably 28 or 30 miles.

From Round island to El Dorado cañon, (five or six miles,) the channel continues good, and without obstruction, except occasional "swift places" of no great moment.

After passing El Dorado cañon, and until Roaring rapids are reached, (a distance of about eight miles,) the channel continues good, with smooth water, but a quicker current. No impediment is found here that could be at all serious in any stage of the water until arrival at the famous Roaring rapids.

These rapids are caused by bars, composed of rock, gravel, and boulders, which make out obliquely from each side of the river toward the centre. The current striking these bars is deflected with a strong swell or roll from each bank towards the middle of the channel. These swells cause the water to break where they meet, and the water has then a straight rapid shoot down the contracted channel in the middle of the river. With the lead no bottom could be found in the rapids. The water appeared very deep, probably as much as 30 feet. The rapid water may be altogether 500 yards in extent, but of this the great obstruction is found in only 200 to 300 feet; there the straight rapid shoot above described is located. In these 200 to 300 feet the descent of the water is plainly perceptible to the eye. By the use of a water-level it was found to fall in the neighborhood of four feet in the distance named. There is a rock here standing about five feet out of water, which is probably covered when the river is high, but is easily avoided, and in fact it would be difficult to run upon it, as the swell and the course of the current would set a boat away from it.

To pass the 200 to 300 feet of rapid broken water described, the Esmeralda placed a ring-bolt in the rocks above, (the only ring-bolt used on the trip,) and ran a line 800 feet in length to it. This line was taken to the steam capstan on the single purchase, and the steamboat was run up the 800 feet to the ring-bolt in seven minutes easily, and without apparent strain. For perhaps three-fourths of the 800 feet the steamboat slowly backed her wheel to keep her head right.

After running the Esmeralda up, the line was taken to the loaded barge, which was hauled up in about 30 minutes, using the three-fold purchase upon the capstan. At this time the river was at a low stage, probably nearly as low as it usually gets.

From Roaring rapids to Black cañon, (about 20 miles,) there are a number of rapids. Of these only three are of any consequence, and in them the water scarcely breaks at all. At the rapids the shores were always rocky, but there was ample width in the channel to clear all rocks, which were generally above water. Explorers' rock, situated in this portion of the river, is near mid-channel, and is seldom or never seen above water. Its position, however, is well known, and there is little danger from it, as there is about 100 feet of clear channel-way on either side of it, and the river runs with a still slow current.

Black cañon, from its entrance to its termination, is from 8 to 10 miles in length. In the cañon the river has an average width of perhaps 200 feet. It is here a still deep stream, flowing smoothly, but not very rapidly, between bold rocks, which, for a large part of the way, rise in precipitous walls to an immense height above the water. The channel is free from rocks from shore to shore, and has no sudden or short turns. The Esmeralda towed the barge through the cañon, not running a line more than once or twice, and that only to save fuel.

Leaving Black cañon, the country again becomes open, with occasional bottom lands and grass on either side, up to Vegas Wash, six or eight miles distant. The river resumes its average width of about half a mile; it runs with smooth water, but a strong current, to make head against which the Esmeralda constantly run lines. The lines were, however, only used to economize fuel, which must have been freely used to propel the boat against the quick current. Only the single capstan was used. No bars or rapids were found between Black cañon and Vegas Wash. The channel was in width and depth about equal to that of the lower river. A small tribe of Indians live along the banks of the river.

From Vegas Wash to Callville, (12 to 15 miles,) the Colorado has a smooth slack current, and plenty of water. The country along the river is mostly mesa and sand, but with considerable land that seemed fit for cultivation. A few Indians are living upon this section. There is scarcely any timber growing from Black cañon to Callville, (what was seen was willow and mesquite,) but a little drift-wood lodges along the banks for the whole distance. Besides what the Esmeralda used, she left about enough of this drift-wood for one more trip up.

Nothing was seen of the Colorado above Callville. Information obtained showed that a steamboat might possibly be taken up, with difficulty, to a point 30 miles higher, but that there, owing to the crooks in the river, she would be but eight miles distant in a straight line by land from Callville. Mr. Smith, the Mormon agent, stated that three men, at different times, and each ignorant of the other's proceedings, had been sent by Brigham Young from Salt Lake, to examine the river and adjacent country; and that each had separately reported that Callville must be the head of navigation.

THE CAVE.—Two or three miles below Roaring rapids, and in sight of them, the river at a bend strikes the face of a steep rocky mountain. The action of the water has here scooped or hollowed out a very remarkable cave, about 70 feet in width at its entrance, extending directly into the rock for about 200 feet, and having a height of perhaps 50 or 60 feet. The current setting into and out of this cave carries in and deposits sufficient drift-wood to keep it full to extreme high-water mark. When the Esmeralda stopped here for wood it was found piled in to the height of 20 feet above the then stage of water, filling the cave to about that height for nearly the whole extent. It is supposed that if the cave were cleared out every year, it would be filled afresh by the season's drift. If this be so, it will be readily understood how valuable the cave may become to a steamboat line to Callville. There are high grounds near by upon which the wood, when taken out, could be safely piled.

GENERAL OBSERVATIONS UPON THE RIVER, &C.—The average current of the Colorado at ordinary low stages, where no contraction or special obstruction exists, may be about three and a half miles per hour. At high water it is of course more rapid. Against such a current the Esmeralda, when under way, towing a loaded barge, would make about 40 miles per day from point to point, running only during daylight. When regular navigation is established boats will undoubtedly run day and night, except that when reaching any difficult place at night it may be necessary to wait for daylight, to pass. At least this will be the case for the greater part of the passage to Callville, say from Port Isabel to El Dorado cañon, distance about 350 miles. Whenever steamboats get to running frequently and regularly, the constant stirring of the sand upon the bars will, it is believed, keep them washing away, so that a good depth of water may always be found upon them. A steamboat for the Callville trade should have an 18-inch cylinder, draw not over 20 inches, and be not over 140 feet in length, with a large stern wheel. A boat like this would go from Point Isabel to Callville, with a barge in tow carrying 200 tons of goods, in 14 days, running only by daylight, at almost any stage of the river. When boats of this description are placed upon the river, the trips will be made with the same regularity and certainty as on the rivers of California. Up to this time there has never been a suitable boat on the Colorado. All are deficient in power and size, and some draw too much water. The Indians living along the whole length of the river are friendly and peaceable.

Rough estimate of distances.

Port Isabel to Fort Yuma	175 miles.
Fort Yuma to La Paz, 175 miles	350 "
La Paz to Williams Fork, 80 miles	430 "
Williams Fork to Mohave cañon, 18 miles	450 "
Mohave cañon to Hardyville, 60 miles	510 "
Hardyville to Cottonwood island, 30 miles	540 "
Cottonwood island to Callville, 60 miles	600 "

OTHER STATEMENTS.—At the same public meeting, R. G. Sneath, esq., of San Francisco, said he believed that freight could be put down at Callville for four cents per pound, and that a chance was now offered to supply 125,000 to 130,000 people with the necessaries of life, and they ought to take advantage of it. In answer to question put by the chairman, he said that he believed that it would take from 30 to 60 days to run a cargo through to Callville. It would have to be transhipped at the mouth of the river, and it might be well to transfer it again to a powerful boat below the rapids.

Captain Rogers said, as far as his knowledge went. there was no particular trouble in navigating the river. There was a scarcity of wood for 50 miles below Callville, but the Mormons told him that there was a mountain at the back of that place where there was plenty of wood, which could be obtained at reasonable rates, say about $7 per cord. Wood could be procured the whole length of the river for from $3 to $4 per cord, and by cutting it themselves, for us. He thought that when proper arrangements were perfected the trip could be made inside of 15 days. The expense of running a steamer was less there than here; it did not cost nearly so much on the Colorado as on the Sacramento river. Labor and wood were cheaper there. They pay $50 per month to men on the Sacramento, and on the Colorado only $25; they pay $6 per cord for wood on the former river, and only $3 on the latter.

Captain Rogers, in answer to questions, said that the currents were stronger and not so regular, on the Colorado, than on the Sacramento, but there was deeper water on the former. There were no sand-bars to speak of above Fort Mohave, and the river was not practically more difficult to navigate than the waters of the upper Missouri. He had no doubt in the world that it would prove the best paying institution on the coast; it would certainly pay better than the Sacramento river.[*]

SECTION IV.

CENTRAL ARIZONA.

It was not until 1862 and 1863 that an attempt was made thoroughly to explore Central Arizona. Whipple and Beale had crossed by the 35th parallel; Aubry and Leroux had seen something of the Salt and Verde rivers, the chief northern tributaries of the Gila; but no one had attempted more than a hurried passage through the country, although all believed it to be rich in the precious ores. Late in 1862, or early in 1863, Powel or Pauline Weaver, a noted mountain man, who had crossed Arizona by the Gila as early as 1832, was attracted by the placers at La Paz to look for others in the interior of the country, and started with a party of men for exploration. He found what have since been known as the Weaver diggings, near Antelope Hill and the town of Weaver, some sixty miles south of the present town of Prescott. About the same time Joseph Walker, another well-known and veteran pioneer, arrived at Pima Villages with a party of gold hunters, and determined to go north to see what the unexplored country, from which the Indians had often brought fabulous reports, really contained in the way of precious metals. This party discovered and ascended the Hassyampa, one of the main streams of Central Arizona, which has its rise about ten miles southeast of the town of Prescott, and runs nearly south until it sinks in the desert some twelve miles below the town of Wickenburg. Part of the Walker party went to the Weaver diggings, where on the top of Antelope Hill, in a most remarkable position, Mr. Snelling discovered a large quantity of gold, much of it in pieces of unusual size. One nugget weighing a half pound was taken out. Much of the mineral was dug out with common jack-knives, and one man is said to have taken out $4,000 in a single day. It is the common impression that if water could be had at the top of the mountain much of the soil would pay very richly. A large amount of work has been done, and a great deal of money taken out along the creek at the foot of the mountain, where the mining town of Weaver is located.

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[*] Although the description given of the Colorado river in the above report is substantially correct so far as relates to its general features, the difficulties of its navigation are considerably underrated. It should be borne in mind that these representations are made by parties interested in getting up a scheme to secure the Utah trade. So far from the depth of water being greater on the Colorado than on the Sacramento, my own experience from Fort Mojave to Fort Yuma, and all the testimony I have been enabled to gather on the subject, furnish direct proof to the contrary. The depth at the ordinary low stage on the Colorado is not more than two and a half feet on the bars. In January, 1865, the Cocopah, under command of Captain Robinson, one of the most experienced pilots on the river, was nearly two months making the trip from Fort Yuma to Fort Mojave, and the draught of this boat was not over 24 inches. She was compelled to transfer all her freight to barges after passing La Paz. On the return trip from Fort Mojave to Fort Yuma, without any freight whatever, she took nine days to make a distance of less than 300 miles down stream. The great difficulty arises from the constant shifting of the channels, caused by the caving of banks, deposits of sand in new places, and consequent changes in the direction of the current. It is a peculiarity of the river that any improvement made in the way of dams, wings, or weirs must, from its very nature, be of temporary benefit. The natural laws which govern this stream are constantly in operation. New caves in the alluvial banks throw the current out of the existing channels; and even where this cannot occur, there are always new deposits of sand made at their lower extremity, thus creating new obstacles. The Roaring Rapids form an almost insuperable barrier to navigation beyond that point, but it would be less difficult to make a permanent improvement there, where the banks are rocky, than in the long stretches of the river below, where the banks are composed of sand. It certainly requires something more than the unsupported statement of an interested party, however reliable, to justify the assertion that the Colorado is superior to the Sacramento as a navigable stream, or that it can ever compete with the latter river in the extent or value of its trade. There is neither the population nor the natural facilities to justify such a conclusion. Small steamers may possibly be constructed to navigate the Colorado to greater advantage than those now in use, but I am clearly of opinion that no extensive trade will ever be carried on with Salt Lake City by the way of Callville.—J. R. B.

The Walker party gradually ascended to Hassyampa, finding gold at nearly every point, and in the winter of 1863 and 1864 taking possession of the Lynx or Walker Creek diggings, (ten miles east of Prescott,) from which it is estimated that little, if any, less than a half million of dollars have been taken. They also gathered much gold on Big Bug creek, four miles east of Lynx creek. As the placers were pretty well worked the miners began to look for quartz veins, and found no lack of them. All along the Hassyampa, upon the Agua Frio, a parallel stream of considerable size, upon Lynx creek, Big Bug, Turkey creek, and indeed upon nearly all the streams of Central Arizona lodes of gold, silver, and copper were found. In the excitement a great many were named and recorded which have no value.

GENERAL VIEW OF THE PRESCOTT REGION OF COUNTRY.*—There are three elevated ranges of mountains preserving an approximate parallelism and trending in general north and south. Between them are wide meridianal depressions, occupied by grass plains.

The eastern range is called the Tonto Plateau, and is composed of horizontal strata of lime and sandstone, resting upon the surface of a broken granite system. The surface or summit of the chain is quite evenly level, a plateau of fifteen miles wide and over a hundred long covered with pines. West of this and separated from it by the Tonto or Prescott plains, lies the Sierra Prieta; a continuous elevated ridge of about 60 miles in length.

Westward again is the Skull mountain chain, a less important formation.

These will be described separately.

The broad valleys between the two first ranges open northward and connect with the great Val de China, which lies beyond, bounded on the northeast by escarped mural edge of the great Plateau or Colorado Mesa, and on the west by the mass of the Aztec mountains. This extended valley or plain system is all connected, and the entire drainage empties around the northern end of the Tonto mountains into the west branch of the Rio Verdé.

The valley lying west of the Sierra Prieta drains the Williams fork.

THE TONTO PLATEAU.—This singular table range is unlike most chains in Arizona. It is, in fact, a part of the grand Mesa; its summit being on the exact level of the plateau, and only separated from it on the east by the deeply crowded cañon of the Rio Verdé. This stream has cut down a valley of about 3,000 feet deep, and thus isolated the Tonto range, leaving it as an outlying strip of plateau, having the aspect from the country on either side of a true range. The excavation of vast valleys on its western side have left a high escarpment of its strata on that flank.

Along its base, where the erosin has cut deepest, granite cones of the underlying system are laid bare, curiously varying the general aspect.

The exact limit of this table in its southern extension is not yet known, but like the Sierra Prieta it must finally sink under the low plains of the Rio Salado and Gila.

Its summit is about 8,000 feet high, rising at the northern end to nearly 9,000 above sea level. Forests of *pinus Fremontiana* and *pinus ponderosa* grow in considerable extent over its more elevated portions, and a most luxuriant growth of bunch and gramma grasses is everywhere found. Water is rare except in the two rainy seasons.

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* Report of Clarence King, esq., of the State geological survey of California, to Colonel R. S. Williamson on the geological features of Northern Arizona.

THE SIERRA PRIETA.—By referring to the map, the geographical position and extent of this important claim will be easily seen. I shall confine myself to a few notes on its structure, and the distribution of waters and timber.

From our elevated position upon one of its culminating peaks, we could look down the line of the range and overlook a large portion of the wide-spread foot-hill system. In this description I shall use all the notes afterwards made from other points of view, both from the valley of Kirkland creek and the summits of the Aztec chain.

GRANITE MOUNTAIN, THE NORTHERN TERMINUS OF SIERRA PRIETA.—An immense pile of granite rears out of the plains and low foot-hills which stretch eastward and south from the Aztec mountains. To the eastward it presents a very rugged front, deep scored by ravines and ribbed by cragged, precipitous spurs. It is an elongated mass, ending northward in barren rock cones of 700 or 800 feet in height, and on the south extending into the summit ridge of the chain. Within a radius of four or five miles of the base the whole distance is occupied by low ridge-like masses of granite, which are covered with immense detached boulders poised one upon another in strange positions. Among these are many egg-shaped masses weighing 80 to 100 tons, balanced on the small end.

GENERAL STRUCTURE OF THE RANGE.—The granitic ridge terminating in the peak just mentioned extends southward for about 65 miles, maintaining an average elevation of nearly 8,000 feet, rising in three conspicuous places to about 9,000 feet each. These are Granite mountain, the northern terminus, Mount Union, about the middle of the range, and Bradshaw's mountain, its southern end. Its average extention latterally is 25 miles. The topography is comparatively simple, consisting of the central ridge, which is usually straight, and from which, at right angles on either side, project long rocky spurs descending at easy grades to the plains on both sides.

Tabular masses of nearly horizontal, sedimentary rocks rest unconformably on the spurs in the Big Bug district, south of Prescott, varying the rolling character of the surface. These isolated fragments of mesas are, without doubt, relics of the same beds which form the Tonto and Colorado plateau, and which have been accidentally left in the great period of erosim, when the main mass of overlying rock was worn away and carried off from the granitic flanks of the Sierra. Accompanying the granite is a system of highly inclined (and even vertical) rocks, which strike with the range, skirting its eastern base, and forming the material of the lower foot-hills. Southward of Prescott this series of rocks widen, and finally occupy more than half of the eastern slope.

They are of great importance geologically, as being the chief auriferous rock of the region, and enclosing, parallel with their stratification, the main quartz lodes of the Prescott and Big Bug districts. Metamorphic slates, mica sheets and quartzites are the principal rocks, but there is interbedded a fine seam of micaceous oxyd of iron, a hematite of apparently great purity. This zone seems to be about 15 feet thick, and I have traced its indications for about 17 miles. West of Mint valley it is conspicuous in a sharp purple outcrop, which may be followed north and south for several miles, dipping about 85° to the east.

The detrital matter, sand, gravel and clay, which has been brought down from the slopes of the chain and deposited by former torrents in valleys among the lowest foot-hills, and even out upon the plains, has, in crossing the auriferous zone, become mixed with its peculiar rocks, and contains the gold resulting from their disintegration and decomposition. These gravel deposits and stream sands, although never (so far as known) so rich as the placer washings of California, are yet sufficiently charged with the precious dust to pay for washing, especially where water enough for extended operations is present. It is curious to observe along the placer grounds of this region numerous obscure traces of the former inhabitants.

Circular mounds of stones occupy many of the little knolls and heights along the streams, and everywhere they exist numberless fragments of earthenware and glazed pottery are thickly strewn over the surface. That these ruins are of considerable age is proved by large cedar trees whose roots penetrate and embrace the confused rock piles, and which, by examination of the rings of growth, are found to be, in some cases, not less than 200 years old. It is firmly believed by many placer miners that the gold ground has formerly been washed over. This idea is based on the disturbed position of the boulders and gravel in the earth, and a frequent absence of that regular bedded structure which materials deposited by water generally have, and which the digging over and washing by miners must obliterate. It will not be long before this must be established or disproven, for it is impossible to suppose that no implements would be lost (and embedded in the gravel) by these ancient miners. It will be an interesting piece of history if the proof is finally found, that the former inhabitants, whose origin and life and disappearance is so wrapped in mystery, were, like the present settlers, in quest of gold. Of the metalic contents of the Sierra Prieta little is yet known. Gold is known to exist in considerable amount, how richly and how widely distributed time only can tell; rich surface specimens and the exaggerated ideas of prospectors are, of course, no more than an indication, not even amounting to a probability. That the rocks are remarkably rich in large quartz veins is true, but their characteristics are utterly unknown, and the rich surface distribution may not be continuous in depth.

Iron I have before mentioned as existing in a bed of hematite, but unfortunately the want of coal forbids the extraction of this most precious metal. It is quite possible, however, that the plateau strata lying east of the Rio Verde, and which are yet wholly unexplored, may be found to yield coal. Silver is present in certain galena veins in workable percentage. I examined, chemically, at General Mason's laboratory, one specimen which contained over $400 to the ton. The copper indications are frequent, but as yet no deposit has been sufficiently prospected to throw light on its occurrence. The soil of the mountain valleys along the chain is often rich in elements of fertility, but from the great elevation and great nocturnal radiation in the clear summer months, it is found that few crops can bear the rigorous climate, frosts occurring in every month of the year.

TIMBER OF THE SIERRA PRIETA.—Everywhere above 5,000 feet the range is heavily wooded with coniferous trees, chiefly the *pinus ponderosa*, which ranges from the elevation mentioned quite to the summit. It has about the same habit of growth as on the flanks of the Sierra Nevada, but averages considerably less in height; its average is hardly over 150 feet. The timber of this species is decidedly better than in California, where, from the long-continued dry season, or some other powerful climatic cause, the wood is so brittle that a tree in falling will often break in five or six sections.

All along the more elevated parts of the range are scattered groves of a fir, *(abies Douglassii,)* and the piñon, *(pinus edulis,)* also a slender balsam fir, (probably *picca grandis.)* The timber of all these is very good for all the ordinary architectural purposes.

A poplar, *(p. fremaloides,)* a tree having a very white bark and ragged, wide branching habit, is found on the upper waters of all the streams, even about springs at the summit. Its timber is too soft for most uses.

Another of the poplar family (a cottonwood) skirts the stream banks and beds in their levels, and continues downward into the extreme foot-hills to the sinking grounds.

Near the lower limits of the yellow pine timber are live oaks of two species, generally too small to be of value, and a large wide-spreading juniper, *(j. pachyptilœa.)* These last are dotted over the foot-hills in open groves, and together with a walnut, which generally keeps the immediate vicinity of streams, stray quite out into the plains. For 50 miles in length, by from 16 to 20 broad, the range is well timbered with the above species, and is decidedly the most favored region in this respect within a great distance. Very many years of settlement and enterprise would be required to make a serious inroad on this valuable woodland, and unless the mines should prove extraordinarily rich it will always supply a large demand.

WATER SYSTEM OF SIERRA PRIETA.—Climatic causes, which everywhere govern the distribution of waters, are somewhat peculiar in their action in this region. We have not yet sufficient knowledge of the atmospheric changes to thoroughly understand the deportment of streams.

In general, during the winter months, there is an immense precipitation of vapor over the whole plateau, which is deposited in the form of snow in heavy banks upon all the mountain chains and more elevated rolls of mesa. This period is not one of continuous cold, but is frequently broken by a few days, or even weeks, of mild weather, when the power of the sun rapidly melts great quantities of snow, and all the brooks of the Sierra Prieta are brimfull. The clear nights during winter produce an intense cold, the thermometer, even at Prescott, several times indicating as low as 11°, Fahrenheit; the melting of snow is suspended and much of the surface water frozen up, so that in the morning the stream is very low, while by 3 o'clock p. m. of the same day it is a torrent.

The period of winter is followed by a warm spring, when the air, instead of showing a difference of only 3° or 5° between wet and dry bulbs, indicates 28° and 30° of difference.

The mountain snows are rapidly melted, and by May are nearly disappeared; then the streams gradually fall, the volume of water becomes less and less. Finally they shrink back into the mountains, having an intermittent flow, chiefly hidden underneath the rivers of sand which fill their beds. Constant and rapid evaporation, caused by the thirsty condition of the heated air, renders the remaining waters alkaline. This season of droughts and shrunken streams gives way in July and August to a second wet season, one of copious summer showers. The conditions and geographical extent of this rain-fall are not known.

Vast masses of cloud are almost daily condensed over the crest line of the Sierra Prieta, and toward the middle of the afternoon drift eastward. Similar storms gather along the Aztec mountains and around the isolated volcanic cones of the upper mesa. This discharge of rain is represented to be very rapid and great, and as accompanied by a brilliant display of lightning.

The course of these storms seems to be, according to general testimony, from the Sierra Prieta eastward, and from San Francisco mountains southward and eastward, over the Megollon mesa. This phenomenon, of almost daily occurrence during July, August, and early September, at the very season when over the greater part of Arizona plants are dying of thirst, has a powerful influence on vegetation, redeeming the land within its range from the condition of a desert. The influence of this season on the streams is not so great as would be expected, from which I am inclined to think that the discharge is chiefly over plains, where its irrigating effect is seen in a fine crop of grass.

Water for steam purposes in the mining region is plenty, if used economically, throughout the whole Sierra Prieta, but all placer works, except single rockers, must be suspended during about half the year.

GRASS PLAINS NEAR PRESCOTT.—The streams which rise among the volcanic group on the Colorado mesa join those from the Aztec range, and have excavated out of the mesa formations broad valleys, whose general elevation is from 5,000 feet to 5,600 feet above the sea. Of these the largest is known as the Val de China. Williamson's valley, lying north of the Sierra Prieta, is also connected as an arm to the Val de China, and in the same drainage system are the connected plains between the Tonto and Prieta ranges. Taken together they form an area of not less than 500,000 acres; add to this about 300,000 acres of thinly wooded foot-hills surrounding the plains, and, like them, well supplied with grass, and we have a region of grass land of nearly a million acres.

In the coldest winters snow, although on rare occasions quite covering this area, never lies more than a few days.

At present, owing to the Apaches, stock-raising is not possible, but if the mines should half come up to the wealthy yield which is confidently predicted by the mine speculators, both civil and military, this vast stock range will be a most valuable accessory to the mining settlements.

The grasses are all of the kinds known as bunch grasses, never forming turf. How these would last if eaten down yearly and cropped closely, it is impossible to say.

Water is not abundant over these plains, but the immense amount of drainage which flows beneath their surface and unite to form the west fork of the Verde, could doubtless be reached by wells not far below the surface.

We remained aloft on the Granite mountain two days, February 21 and 22, studying carefully all the topographical features within the range of view. The night was comfortless, with a wind that cut through our limited supply of blankets, but the mild temperature we found on regaining our camp in the valley soon thawed us out. On the morning of the 24th we started for Skull valley. Our road curved around the northern base of Granite mountain, through a succession of low spurs and intermediate valleys, the former covered with scrub oaks and chapparal plants, and the latter with a scattered carpeting of dry grass and the dead stems of herbaceous plants. Continuing on the curve till our direction was southward, we entered the upper end of a long belt of level grass land lying under the western flank of the Sierra Prieta, and called Skull valley from the number of crania the Apaches have thrown there.

The following day (the 25th) was devoted to a fruitless search after a lost member of our party. The 26th (Sunday) was likewise spent in trailing the missing man, and by nightfall we determined that he must have gone to Skull Valley settlement. Four of us rode down there at midnight and found that Brinley was safe and had started back to look for our camp.

A little after sunrise next morning we met the wanderer and took him back to camp. Monday Mr. Gardner and I, with one soldier, climbed a bold granite cone north of our camp, from the summit of which we had a fine topographical view.

Near us, and bordering the Skull mountains, lay a rolling belt of foot-hills, chapparal-covered and roughened by outcrops of granite.

SKULL VALLEY.—This level valley is approximately 20 miles long, with bottom land of varying width, from one-fourth to a mile, and winds between the foot-hills of the Sierra Prieta on the one side and a range of granite and sedimentary rocks on the other. It is intersected about midway by a cross ridge of granite, which has acted as a retaining wall to the accumulating detritus washing down from the mountain sides above it, damming it back and elevating the northern portion of the valley about 150 feet higher than the other. The material of the northern section is mostly of disintegrated granite, and the vegetation of a poor character, except two species of live oak, which flourish finely and seem always to like a granitic soil. South of the granite ridge there is a decided improvement in the soil, owing to the presence of metamorphic (*mal pais*) rocks lying west of the bottom.

Here are the farming settlements, founded on a deep black mould of great fertility; with a climate never very cold nor ever intensely hot, they may hope to accomplish considerable agricultural development. The waters of this valley flow southward through a gap in the metamorphic hills, and empty into Kirkland creek, a tributary of the Santa Maria.

In the granite hills which project from the western range into the head of

Skull valley, is a living spring that contains sufficient water for a large camp, even in dry seasons; good bunch grass under the live oaks and scattered among the chapparal on all the hills, and a plenty of fire-wood, make this an attractive camp.

The chain of granitic hills lying west of Skull valley are at their southern end depressed, and finally buried beneath sedimentary beds. These are physically of little importance, except as being the divide or water shed between Kirkland creek and the Santa Maria. From the granite cone spoken of above we obtained our first near view of the great and interesting basin of the Santa Maria.

It seemed to us at first like a confused labyrinth of rock ridges piled up one above the other without system or order, but a further study from several other points, overlooking it more completely, and several tramps into its depths, gave us a good knowledge of its structure. Before describing this singular place, I will anticipate our work a little, and give the results we arrived at in the road reconnoissance up to the Skull valley settlements.

A road from Prescott, either to the settlement at Wickenburg, to La Paz, or to the mouth of Bill Williams Fork, must either follow the present road to Mint valley and around the northern base of Granite mountain, and down to Skull valley, making a long horseshoe curve, and returning in a distance of 38 miles to within 16 of the starting point, or cross the high range directly. We explored two passes over the mountains, one directly west of Prescott, which, from the great accumulation of winter snow, would be quite impassable during five months, and another called the Indian pass, which offers great facility for the construction of a road. The Apaches rarely fail to decide wisely on all matters of trail; a well-beaten path through the pass attests their sagacity. This depression can hardly be over 1,000 feet above Prescott, and from its open, exposed nature it can hardly have more snow than the valley at Fort Whipple. Approached from the Prescott side, the pass is reached by a gentle ascent through rolling wooded country, and without any of the difficulties of ordinary mountain roads. A good covering of soil and generally even surface leaves little to be done beside occasionally digging out stumps or picking away a few stones. The descent into Skull valley, although not so gentle as on the eastern slope, still presents no obstacles, either of grade or rocky surface, which cannot be overcome by a small expendiure. A road through here would be always passable, and would reach the Skull valley settlements in about 17 miles, saving 18 or 19 miles, and reaching the valley in one day less than by the present road.

Having reached Skull valley, a road from Prescott to Bill Williams Fork must either follow the present line to Date creek, or else cross the Skull mountains below Tonto spring and keep the high mesas of the Santa Maria. This latter is the shortest way, and we explored it to determine its practicability.

February 28 we crossed the divide about a quarter of a mile from camp No. 4, and descended gradually among rolling chapparal-covered hills, following the dry tributary of the Santa Maria. After marching about four miles we found ourselves on the brink of a deep impassable cañon, with rugged vertical walls of black cellular rocks. In the bottom were chaotic piles of angular debris, forbidding a passage down the cañon, even had we found a place to descend. To go around the head of the cañon would only lead into a maze of deeper ones. Our only way was to keep the high mesa and work westward parallel to the cañon, crossing the lateral gorges which were made by its tributary streams. Into one of these we were forced to descend to a depth of fully 1,000 feet, and at an angle so great as to forbid the approach of a wagon road, except by zigzag to and fro at great expense. Having regained the opposite summit of the mesa, we continued southwest, following an old Indian trail skirting the borders of the cañon. The surface of this plateau is thickly strewn with blocks and fragments of all sizes of a dark brown cellular rock, half buried in the earth; their sharp edges cut our mules' hoofs, and rendered footing exceedingly insecure

The soil formed by the decomposition of this *mal pais* rock forms, when thoroughly soaked in the wet season, a remarkably tenacious miry clay, which alone, even if there were no difficult cañons, would at times make a road quite impassable.

The mules struggled on over this rough table-land, and about the middle of the afternoon brought us to a singular depression, where we found water and camped.

A granite cone rose out of the *mal pais*, and all around its base the strata have been worn away, leaving a round basin, in the middle of which is the cone of 1,500 or 1,800 feet height. Here is permanent water in tanks, and a good camp ground; grass, in great quantities and of excellent kinds, abounds all over the neighboring hills and mesas, and wood enough for all camp purposes may be collected from the shrubby cedars. Mr. Gardner climbed the cone on the following day, while I explored the cañons and tables for a road line.

From this camp we made a number of pedestrian excursions, getting at last a complete knowledge of the surrounding topography. The difficulties which lie in the way of a road are all of them of a nature that can be overcome, but only with a very great expenditure. Compared with the very small gain in distance over the Date Creek road, it is much more than compensated by the accidental character of the ground.

In moving our camp we descended into a cañon which winds through a labyrinth of confused piles of granite, the trail doubling and twining to avoid impassable crags, and finally emerging on the edge of a mesa, from which a steep declivity of about a thousand feet leads to the rolling country bordering the valley of Kirkland creek.

Thompson's valley is a circular expansion of the main Kirkland valley, and is of topographical interest, as its present water system is divided by a low, flat spur, a half draining down one side of a high granitic ridge and half down the other, uniting about four miles below, and flowing as one stream into the Santa Maria.

We followed the dry cañon of the northern branch, keeping the narrow, sandy bed as it wound back and forth between the interlocking spurs which jutted from high granitic ridges on either side. Tall, monumental plants of the *Cerius Giganticus* stood erect among the debris and rock ruins; their shafts of fluted green, leafless, and trimmed with thorns, heighten the savage aspect of the defile.

The pass opens, after four miles of winding, into an open valley lying along the Santa Maria. This level area of about 2,000 acres of sandy soil is bordered on the west by granitic mountains, through which the river in its westward course has cut a deep gateway. Upon the east is a high boundary wall, formed of the escarped edge of the mesa. Here we camped for about 10 days.

After exploring in all directions as far as we could on foot, Mr. Gardner, Mr. Brinley, and myself, with three soldiers, made a little trip northwestward, climbing two high steps of the mesa system, and reaching, after two hard days' tramp, a culminating point of the Aztec range. This we climbed and spent two days on its summit.

Our first day was half in clouds, half in sunshine. Bitter snow-storms, which almost hourly swept over, accompanied by thunder, completely shut out all view. These alternate periods of cloud shadows and sudden bursts of dazzling sunlight were of wonderful picturesqueness, but they rendered our work very unsatisfactory. The second day, however, was of that peculiar clearness which so often succeeds a storm in mountain countries. The immediately surrounding region, from the Mojave road, at Fort Rock springs, down to Date creek, excluding the remarkable basin of the Santa Maria, was in plain sight and in position to be easily studied out. The great plateau is not broken off here in one high bluff, as in the Val de China and Yampai valley, but descends in long slopes and broken steps, which are everywhere cut by remarkably broken, abrupt cañons. The Santa Maria basin was itself excavated by aquaceous action from one of these steps, and then in a subsequent period of much greater erosive action was deeply gashed down by narrow, converging cañons, with tabular ridges, mere tongues of land, left between them, so that the former surface of the basin is now 2,000 and 3,000 feet above the present stream beds, and only remains in the form of mesa peninsulas. Among these, here and there rise bold granite peaks, of generally angular outline and rugged surface, suggesting the architecture of mighty pyramids from the solid strata which have long overwhelmed and hidden them. A more difficult region to travel over cannot be imagined, nor one which presents less inducement for settlements.

The mesa plains are indeed well clothed with grass, but they are hard to reach and far from any tillable land; besides, the dry climate and scarcity of water must always keep them in their present desolate condition.

The great streams have long ago shrunken away. The torrents which excavated these remarkable cañons are generally now a mere river of sand, only flowing during the rapid melting of snows on the neighboring hills, or rarely in summer, when a dense storm-cloud bursts over the gulf walls and pours down its deluge.

There is evidence that even now these occasional floods sometimes occur. With their exception the streams are mere brooklets, saturated with bitter alkaline salts, and for the greater part of their course trickling and filtering along the bed rock under a covering of hot sand.

The water-loving cottonwoods, by deeply rooting themselves on the margin of these river beds, where they can drink up the subterranean moisture, manage to live, their fresh, vivid green contrasting strongly with the red-brown rocks and dusky olive vegetation of artemesia and larrea.

From our station we could trace each cañon, and here and there a widening of the walls would open to view the lower depths, where a line of rich green willows and cottonwoods fringed the sandy stream bed.

Northward and northwest the long level table lines are broken by Cygnus and Gemini, two lofty snow-clad mountains, the former an irregular pile, capped by a rough-hewn dome, the latter a symmetrical cone of black volcanic material. Between them and encircling their bases is a slope of mesa, furrowed by cañons, which deepen as they continue westward till they break through among the mesa steps and granitic hills of the aquareous range, uniting under its western base to form the main cañon of Bill Williams Fork.

This cañon drains the whole of a long meridianal valley, excavated out of horizontal strata of rock between the two parallel ranges, the Hualapais and Aquarius.

The whole view is one of desolation, relieved, it is true, here and there by vegetation—cedars on the higher mesas, grasses and chapparal plants dotted over the rough hill slopes—yet the solid rock foundation constantly outcrops in sombre red and black masses, shattered into collosal fragments and cut down by a labyrinth of cañons. It produces a picture of savage nature, quite in keeping with the fiendlike Apaches who make their dens in its fastnesses.

Beyond, to the southwest, lies stretched a low desert plain, sloping in almost imperceptible graduation toward the two rivers Colorado and Gila. Detached mountain groups rise here and there, scored down by deep dry gorges. Everywhere a great volume of sand and gravel descends from their mouths, giving evidence of a former torrent.

The vegetation is sparse, and only of desert-loving shrubs, whose ill-favored leaves, together with the cactus thorns, seem typical of the whole region.

Lynx Creek.—Writing from Prescott in 1866, Mr. Ehrenberg used the following language:

> We may safely say there is a continuous range of gold-bearing rock from near Wickenberg to 10 miles north of Prescott, and from the Lower Hassyampa to the Agua Frio, which

would embrace an area of at least 1,000 square miles. The containing rock is nearly the same in this entire section. It does not follow that other sections east and southeast are not metalliferous, nor does it augur for the non-existence of other metals here; on the contrary, lead and copper ores abound, and silver has been found to some extent; but gold predominates, at least as far as known at present.

The first lode upon which machinery was erected was the Accidental, upon Lynx creek, a gold vein yielding some showy and beautiful specimens of free gold—specimens which attracted great attention in San Francisco. The ore crushed by the small mill and prior and subsequently by arrastras averaged about $100 per ton. The vein is small, varying from 12 to 20 inches in width.

Near the head of Lynx creek, which has been worked for placers throughout its length, say 12 miles, is a hill crowded with quartz lodes. This is known as Eureka Hill, and Mr. Ehrenberg, writing (in 1866) of the lodes in it says:

> I find them to be of the same decomposed character as those on the hill below the Big Bug mine, only showing sulphurets in abundance, which those in Big Bug do not as yet. I cannot come to any conclusion as to their real character. More and judicious work is required to do this. There are a great many veins here of this character—more, indeed, than I like to see; still, if this class of veins and ores will pay, by all I can see and what I can hear I can only come to the conclusion that these mountains contain an extent of productive quartz not equalled in any part of the United States.

THE EUREKA LODE is the most prominent in the hill. It is a large vein, and near the surface showed free gold, which, worked in arrastras, yielded $60 per ton, but at the bottom of a shaft of 80 feet in depth sulphurets predominate, and it is the belief that the same will be found in most if not all of the Lynx creek lodes.

THE DEAD WOOD, THE TITIE, THE MOUNT VERNON, THE POINTER, THE BOSTON, THE PINE MOUNTAIN, and other lodes, the ore from which has been worked in arrastras, has returned from $20 to $80 per ton. Sixty tons of the Dead Wood ore, worked by arrastras, yielded $27 50 per ton in gold.

At the head of Lynx creek the Senator lode is a large silver vein, which has worked $60 to the ton in that metal.

THE MOUNTAINEER, BRANDON, LYON, BOX ELDER, MONITOR, and other veins show gold, and have been developed to a sufficient extent to indicate value. The quartz on the surface is decomposed, and the gold often visible. At a depth, as a rule, the ore abounds in sulphurets. Arrastras have been erected, and are now testing the ore from some of these veins. The headwaters of the Hassyampa are near those of Lynx creek, and the quartz lode upon the Hassyampa are generally held in good esteem.

THE CHASE LODE is a gold vein prospecting well, and believed to be valuable.

THE BENEDICT SILVER LODE has a shaft upon it nearly a hundred feet deep.

Good silver has been taken from the McDougal.

STERLING MINE.—This mine, five miles nearly south from Prescott, and near to the Hassyampa, is somewhat noted. Two five-stamp mills have been erected upon it. The ore is of gold sulphurets, and presents the appearance of bronze. It was found impossible to work it profitably by any ordinary process, and the mills have been idle much of the time. Lately a San Francisco gentleman tried a process upon the ore which promises to be a success, and it is believed the mine will prove valuable. The vein is as yet irregular and uncertain; but comparatively little shafting or tunnelling has been done.

THE MONTGOMERY, OFTEN, AND GUADALOUPE MINES, further down the Hassyampa, have been worked to some extent, and yielded some free gold. They are difficult of access at present, but roads might be made to them without great expense.

THE LEIHY COPPER VEINS, between Prescott and Skull valley, show that Central Arizona, no less than Southern Arizona and the Colorado river country, is rich in copper, but it is not likely that attention will be given to working this ore at present. There are some fifty veins in close proximity in the property named, and in other parts of Central Arizona numerous copper lodes have been located. The ores are oxides and sulphurets.

BIG BUG.—East from Lynx creek some four miles, and from Prescott some 15 miles, is the Big Bug creek, and a well-known mining district bearing that name. Every hill in this rough region is mineral bearing. The placers worked upon the creek for many miles paid well, and continue to pay good wages.

Mr. Ehrenberg spent some days, in the spring and summer of 1866, in an examination of this district, and thus described it in a letter written in May to the Alta Californian, of San Francisco:

> The veins, in part of the district at least, are large, distinct, and well defined; in the other parts this is not the case, and I have not yet come to any conclusion as to what they are, as no work whatever has been done on them, and the containing rock is so decomposed and stained with oxide of iron in certain parallel zones and masses that it is even doubtful whether they are veins at all; they have some regularity, nevertheless; and, should this iron stain be caused by the decomposition of pyrites (or sulphates) of iron, then there is hope of numerous extensive and lasting veins, as most all the croppings show gold. It is, however, possible that this rusty stain is caused by the decomposition of the hornblende in the sienite, (or diorite,) which is the rock in which all these veins occur. In this case, not much is to be hoped from this second series of veins. I expect, however, that a few of these also will prove good and permanent.
>
> First, the Galena lode, belonging to the first series. It is a fissure, and fine-looking, large vein, prospecting and opening well. Eight men are at work here in two shafts, from which about 70 tons of ore have been taken up to date, (shafts about 15 feet deep only.) The Galena is situated on the mountains about two miles north of the mill.
>
> Second, the Big Bug, situated about one-half a mile from the mill, also on the mountains, and on the boundary separating the two classes of veins. Some beautiful ores of a singular character are taken from this mine, which make me almost believe that much of this iron stain is occasioned by the decomposition of the hornblende rock, and not by iron pyrites—at least not always. The shaft is some fifty feet deep, but has considerable water in it, which prevented my examining it below at present. They are extracting ore from two small levels some three feet down. The lower wall is very firm, but the upper consists of a crumbling, heterogenous mass of the same material and segregated masses of crystallized hornblende. The fissure in which the ore occurs varies in width from two to four feet, and the ores lie in the same in nests of various sizes, showing by their relative position, however, the probability that at one time they have formed a continuous sheet.
>
> The condition of the hanging wall, and the whole combination or character of the gangue or vein mass make me think very favorably of this vein. The vein mass consists, first, of the ores referred to, segregated masses of recrystallized hornblende, decomposed country rock, with large and small fragments, at times, of the latter, and quartz enveloped and blended with the former in a very peculiar mixture. It is my opinion that considerable friction has been excited at some time on the walls, by which the upper has been shattered and broken, and that in course of time the whole mass has been reconsolidated, and the intervals refilled by recrystallization of hornblende, iron pyrites, &c. Even the ore is of this character, gold generally occurring in the vicinity of brown crystals of iron in the admixture of hornblende and felspar, and in a deposit of carbonate and even sulphate of copper in small quantities. The vein can be traced for a mile in a straight line, showing principally those flush walls of hornblende, with ore in some places. As the shaft was sunk in a ravine it is questionable whether the whole vein has been so much shattered, or whether this was confined to the ravines solely.
>
> Third, the Eugenia, not worked now, and water in the drift, which was commenced too low or too near the creek. This is a vein, consisting of iron pyrites, occurring in a gangue of calcareous spar, (or talc,) with some quartz. Near the surface the iron is oxydized, and the gold can be extracted in the common way. The iron pyrites will require concentration and roasting. I can say nothing of this vein now, further than that it seemed to be of enormous size, and that it is, or can be, worked with great facility, being only one-half mile from the mill, and on nearly the same level. Only the surface ores will be available now, of which there are a great abundance. If these will pay but $15 per ton the mill can be kept running.

At this writing about 1,000 tons of the Galena ore are in sight. Five hundred tons have been worked by the quartz mill erected for the purpose, and although the machinery is incomplete the yield has averaged $25 to the ton in free gold. There are several shafts and tunnels on the lode. The cost of shafting has been from $8 to $40 per foot. Ordinary wages $75 per month and board. Wood costs delivered $5 per ton. The Big Bug mine is of a similar character; 60 tons averaged $30 per ton. The ore from both these mines contains from 10 to 20 per cent. of sulphurets. The Eugenia is at places 10 feet in width.

Several tons worked in arrastras gave $25 per ton; some as high as $40. At such a return as this the Eugenia, from its location near the mine and its size, must, if continuously rich, pay well.

The TICONDEROGA, the CHAPPAREL and the DIVIDEND MINES, in the Big Bug district, have a fair reputation. Thirty tons of the Chapparel ore worked at the Big Bug mill gave $22 per ton in free gold. Sixty tons from the Dividend gave $20 per ton. A mill has been erected upon the Ticonderoga, a lode reputed to be valuable, but little work has yet been done.

TURKEY CREEK, 30 miles southeast from Prescott, is more noted for its silver than for its gold mines. A mill has been erected to work the ore of the Bully Bueno lode, but owing to financial embarrassment it has not yet been put in operation. Shafts and tunnels show the lode to good advantage. The ore is of a curious character, that upon the surface being gold in hornblende. The Yahoo mine in this vicinity promises well. The Goodwin is a silver lode, showing some choice ore. Specimens taken to California in 1865 were highly praised. A ton or two worked yielded $300. The Gross gold lode in this district has yielded some specimens of free gold of rare beauty. The Capital silver lode resembles the Goodwin, and the Richmond is of the same class.

THE BRADSHAW DISTRICT is upon the upper Aqua Frio, at what is known as Black Cañon, a distance of from 50 to 60 miles southeast from Prescott. Here the Mexicans for several seasons worked the placers with considerable success, and in 1864 numerous quartz claims were taken up. Some of the ore reduced in arrastras gave a return of $100 to the ton. The Great Eastern, the White Swan, the Uno, Forks, and other lodes present good surface indications. A company has been formed in Philadelphia for working them. The Nopal and Ballenciana lodes have been worked by arrastras, and some showy specimens have been extracted.

Near Given mountain, at the south side of the Bradshaw mountain, (from which the foregoing district is named,) some silver lodes have been located, but not yet worked. The Mammoth has an average width of 15 feet, and has been traced for two and one-half miles.

PINE FLAT, at the west end of the Bradshaw mountain, has several gold lodes. The Clinton and Minnehaha have been opened to the depth of perhaps 30 feet, and the district is accounted promising.

WALNUT GROVE, one of the best farming districts in central Arizona, is upon the Hassyampa, 30 miles south of Prescott, and 15 miles west of the mining districts just referred to. In its vicinity are some good lodes. The most noted are the Big Rebel, a lode of considerable size, and the Josephine, ore from which, worked by arrastras, has paid $200 to the ton.

At the Placeritas, between Walnut grove and People's ranch, about the time of the Weaver gold excitement, some gold was extracted, and the diggings are still worked by Mexicans.

VULTURE MINE.—A German, named Henry Wickenburg, with several companions, while prospecting upon the Hassyampa late in 1863, discovered a butte or small isolated mountain of quartz, at a point some 60 miles north of the Gila, and near the Hassyampa. After examining it closely they found traces of gold but attached no great value to the ore, and all but Mr. Wickenberg were reluctant to go to even the slight trouble of posting notices claiming the lode, if such it could be called. It was, however, taken up, and is now the best known and most profitable mining property in central Arizona, if not in the entire Territory. Upon the discovery claim is a chimney 500 feet long and 400 feet wide, which rises 100 feet above the surface of the surrounding country. So far as tested nearly all the rock of this chimney contains gold. The vein proper is 39 feet wide, and continues the same at the depth of 100 feet from the surface, or say 200 feet from the top of the chimney, the depth to which shafts have been sunk. The vein runs northwest and southeast. The hanging wall is of porphyry rock; the foot wall of talcose slate. The vein has a pitch of 45° to the northwest. The main lode is all of quartz, and there are various strata on each side, varying from one to six feet in width.

A 20-stamp mill has been erected upon the Hassyampa, within a mile of the town of Wickenburg, where the ore was first worked in arrastras by Mr. Wickenburg and others. This is for working the ore from the discovery claim of the Vulture, which is now the property of a New York company. Mr. Cusenbary, the superintendent, has kindly furnished the following report of the amount of ore worked by this mill to September 1, 1867:

From November 1, 1866, to September 1, 1867, the mill crushed 4,834 tons, which produced $145,633, an average of about $30 per ton.

The gold has thus far been found free, and occasionally some showy specimens are obtained. The absence of water near the lode now renders it necessary to work the ore at Wickenburg, a distance of 14 miles. Thus the cost of transportation alone is $10 per ton. Wood is not abundant in any part of central Arizona south of Prescott. At Wickenburg it costs delivered about $8 per cord.

THE VULTURE is, however, considered rich enough to pay with these drawbacks, and arrangements are now making for the working of other claims, and it is thought that all will pay, although some have heretofore considered the chimney or discovery claim the only desirable part of the lode. Two thousand feet are claimed upon the Vulture vein, and several other lodes of a similar character, although much smaller in size, have been taken up in the vicinity.

GENERAL REMARKS ON CENTRAL ARIZONA.—Central Arizona is an elevated country. The town of Prescott, the present capital of the Territory, is at an altitude of some 6,000 feet above the level of the sea. At this height the winter temperature is of course severe, but at other seasons the climate is perhaps the most agreeable in Arizona. Above Weaver the country is well wooded and watered. The valleys are for the most part small and disconnected, but the soil is rich, and at most points, although there are early frosts, fine crops are produced. It is estimated that 2,000 tons of corn will be produced this season within a circle of 50 miles of Prescott. Vegetables of nearly every kind grow luxuriantly. At a reasonable outlay good roads may be made through the most formidable mountain ranges, and the country offers many facilities for mining. The want of success to this time is not to be attributed to any deficiency in the mines, but to the Indian troubles and the refractory character of the ores of most of the lodes thus far opened. The mills erected having been intended only for the working of free gold have not been suited to sulphurets and rebellious ores. When proper machinery is provided the lodes of central Arizona, or a number of them, will probably repay development. It is estimated that ordinary ores may now be worked at a cost not exceeding $7 per ton. Only American labor is to be had, which is more costly than most of that employed in southern Arizona and upon the Colorado, but at the same time more effective.

REMARKS ON THE TERRITORY.—In southern Arizona and upon the Colorado, excepting at the highest points, work is usually suspended in the summer months. In central Arizona this is not necessary, as the sun is seldom oppressive. The thermometer has been known to stand at 110° on the Colorado, when it rose to but 65° in and about Prescott. The nights in the mountains throughout the Territory are cool at all seasons. Snow falls in central Arizona, but excepting in the higher mountains it usually remains but a few hours. Of the four winters since the whites occupied the country, but one has been severe.

Arizona is far richer in agricultural lands than is generally supposed. To those who have traversed the desert regions only, it would be an absurdity to talk of fine farms and gardens, but with those who have seen the products of the fertile valleys, no argument is necessary to prove their value. Indeed, it may be boldly asserted that no one of the mineral-bearing Territories of the Pacific is richer in mineral lands than Arizona, while its climate is acknowledged by all who have tested it to be unsurpassed upon the western continent. The pastoral resources of the Territory deserve mention. Grasses of every nutritious variety abound, and cattle and sheep may, whenever the hostile Indians are overcome, be raised with comparatively no outlay. Southern Arizona is especially rich in grazing lands, and were its mines to prove worthless, which is hardly possible, it must eventually become important as a pastoral country, and support a large population, furnishing cattle not for the Territory, but for California and New Mexico.

Below Prescott and upon the Colorado adobe is used for building, and is perhaps better suited to the climate than any other material. At Prescott and in the surrounding mining districts timber is used, and lately brick of an excellent character have been made in Prescott.

The pine of central Arizona grows to a medium size, and much of it is resinous. The oak and black walnut do not obtain a great size. Pine lumber cut by a steam mill in Prescott is furnished at $30, $60, and $100 per 1,000, according to the quality. The mesquite and cottonwood of southern Arizona and the Colorado furnish good rafters for the adobe structures, and the mesquite is famed as a superb firewood. About Tucson and Tubac, and many of the mining districts, it is abundant.

The Territory offers two natural and inviting routes for continental railroads. That by the 32d parallel, over which the Butterfield or southern overland stage service was so satisfactorily performed prior to the rebellion, is too well known to require comment. That by the 35th parallel, explored by Beal and Whipple, is scarcely less practicable, and is for much of the distance well supplied with timber and coal, and through a promising agricultural and mining region. Both these routes possess advantages over those farther north, and it is the judgment of those who have passed over them with care and observation that they must both soon be traversed by the iron horse.

Upon the adoption of the code of the Territory, (1864,) a chapter was incorporated providing for "the registry and government of mines and mineral deposits," and it at first met general favor, both in and out of the Territory, but practice proved it to be cumbersome and annoying, and in 1866 it was repealed, and a simple act passed, leaving the regulation of the size of the claims, the amount of work to be performed, and all details connected with the taking up and holding of claims, to the district organizations. But few, however, of the districts enforce rules, and it is not likely that much attention will be given the matter until the congressional mining law is enforced here. The land officers who are to see to its execution have, it is reported, been appointed, and will soon open their offices. The congressional act, so far as understood, is much liked, and considered liberal even by the large class who have always opposed any legislation by Congress regarding the mineral lands.

A simple segregation act, of which the following is a copy, was adopted by the last legislature:

AN ACT to provide for the segregation of mining claims.

Be it enacted by the legislative assembly of the Territory of Arizona, That whenever any one or more joint owners or tenants in common of gold, silver, copper, or mineral-bearing ledges or claims may desire to work or develop such ledge or claim, and any other owner or owners thereof shall fail or refuse to join in said work, after due notice of at least 30 days, given by publication in one newspaper, printed in the county in which said ledges or claims are located, and if none be printed in said county, then in any newspaper printed in the Territory, said notice to have publication in four successive weeks of said paper, said other owner or owners may, upon application to the district court of the district wherein the ledge or claim is situated, cause the interests of said parties so refusing to be set off or segregated as hereinafter set forth.

SEC. 2. The owner or owners of any mineral-bearing ledge or claim, after the expiration of said 30 days' notice having been given, may, if the party or parties notified fail or refuse to join in the working or developing said ledge or claim, apply to the district court of the district wherein the ledge or claim may be situated, for a partition or segregation of the interest or interests of the party or parties so failing or refusing to join.

SEC. 3. The party or parties so applying shall set forth the fact that the said parties have been duly notified in accordance with section one of this act, and that said party or parties have failed or refused to join in said work, all of which shall be sustained by the oath or affirmation of one or more of the parties applying; and upon such application being made the clerk of said court shall post a notice at the office of the county recorder, and in two other conspicuous places within the district, stating the application, and notifying the parties interested, that unless they appear within 60 days, and show good cause why the prayer of the petitioner should not be granted, that the same will be granted if good cause can be shown.

SEC. 4. At the expiration of said 60 days, if the party or parties notified do not appear and show good cause why the prayer of the petitioner should not be granted, the court shall appoint two commissioners to go upon the ground and segregate the claims of the parties so refusing to join; and in case they do not agree, they to choose a third party; and said commissioners shall make a report in writing to said court, who shall issue a decree in conformity with said report, which shall be final, except appeal be taken to the Supreme Court within 30 days after issuance thereof.

SEC. 5. The provisions of this act shall not apply to the county of Yavapai.

SEC. 6. All acts and parts of acts in conflict with the provisions of this act are hereby repealed.

SEC. 7. This act to take effect and be in force from and after its passage.

The present report indicates the discovery and location of lodes in all parts of the Territory rather than their development. The reader may wonder why lodes offering such rich surface indications, and so generally promising, have not been extensively worked. In explanation, the comparative inaccessibility of the Territory, being off the grand overland lines of travel, and without seaports, must be first offered. Next the fiendish Apache, the most difficult Indian upon the continent to overcome, and next the limited extent of the placer diggings, or the lack of water for their working. It will be remembered that it was the placers that brought the large population to California, Idaho, and Montana. Had those countries been without such inducements, their growth would probably have been as slow as that of Arizona.

After some years residence here the writer is more than ever confirmed in the belief that while there is much to contend with in Arizona, there is much to contend for, and that despite all the drawbacks and discouragements the Territory will yet command a large and prosperous population, and abundantly repay the government for the outlay required to reserve it from the savage.

Besides the minerals already referred to, there are indications of the existence of many others in different parts of the Territory. Iron in carbonates and oxides is abundant. Traces of nickel have been found near the Big Bug creek. Platinum (metallic) is shown in the placers of the Black cañon or Bradshaw district, on the Agua Frio. Traces of tin exist at several points. The geologist of Lieutenant Parks's United States exploring expedition reports the discovery of large beds of gypsum upon the San Pedro. A lode of cinnabar was located several years since 10 miles southeast of La Paz, and named the Eugenia; copper, silver, and quicksilver are found together in a rare combination, but the lode is not large. Rich cinnabar float has been found upon the Mohave and Prescott road, about 50 miles from the Colorado. Lime of a superior quality exists in large quantities near Prescott and Tucson, and is found at other points. It is now extensively used in building. Lime coral exists in the Adelphi mine, Mineral hill, Williams Fork. It is found in immediate connection with the richest carbonates and oxides of copper. The Salt mountains near Callville, and a few miles east of the Colorado, are among the most remarkable formations in Arizona. The deposits of pure, transparent, and beautifully crystallized salt are very extensive, and no salt is superior for table or general use. In the vicinity traces of coal have been discovered, and parties engaged in exploration are quite confident that large quantities will be found. There is a report of the discovery of coal upon the San Pedro.

The folly of intrusting mining operations to inexperienced and imprudent men has been well illustrated in Arizona. In the southern country and upon the Colorado hundreds of thousands of dollars have been thrown away in foolish and extravagant expenditures. In one instance, after the outlay of $1,000,000, the company abandoned work without enough having been done to ascertain whether there was or was not a true vein. In many cases the whole capital of the owners has been frittered away in unnecessary buildings, improper machinery, and large remuneration to unworthy agents, men who, next to the Apache, have by their recklessness obstructed the progress of the country, and prejudiced capitalists against further investment in it.

Thus far it may be truthfully asserted that there have been more failures in superintendents than in mines in Arizona; indeed it is a common remark that no lode properly opened and economically and systematically worked has failed to pay. This is true in the main.

In southern Arizona, and upon the Colorado river bottoms, irrigation is necessary. In central Arizona the seasons are defined, and at many points good crops have been raised without irrigation, the rains furnishing sufficient moisture. These occur mainly in the months of July and August, but there are frequent showers in April and May, as well as in the winter months.

The friendly Indians, Pimas, Maricopas, and Papagoes, below the Gila, raise large quantities of excellent wheat, and the whites engaged in farming upon the Gila, the Santa Cruz, the San Pedro, and the Sonoita, raise corn, barley, and wheat. Some six flouring mills are now in operation in the Territory.

UTAH TERRITORY.

SECTION I.

GENERAL FEATURES.

The boundaries of this Territory have been changed a number of times until its form approaches a rectangle. Its length from north to south is about 345 miles, and its breadth about 320 miles, with an area of about 110,000 square miles. Its population is variously estimated at from 80,000 to 100,000, and is rapidly increasing.

The Wasatch range of mountains divides the Territory diagonally northeast and southwest into two parts, the northwestern being much larger than that lying to the southward. The Wasatch range is high and rugged. Its lofty summits, covered with perpetual snow, probably have an altitude of 11,000 or 12,000 feet above the level of the sea. In a broad and elevated range surrounded by countries rich in gold and silver we should expect to find those metals. But so far as is known no range of mountains on the western coast has been found rich in precious metals that has a trend to the northeast and southwest, and it may be considered problematical whether any mines of those metals will be found of great richness in the Wasatch mountains. On the western side of the Territory are a number of small ranges, on the Goshoat and a number of others, that contain mines of gold and silver.

The largest river is the Colorado, one of the longest in the United States. Of its capabilities for navigation comparatively little is known, though so far as explored the reports are unfavorable. Its principal branches are the Green, Grand, San Juan, and Virgin rivers. These drain the southeastern portion of the Territory. On the north, Goose and Holmes's creeks run into Snake river, but all the interior streams empty into lakes that have no outlet to the sea. Bear river and the Jordan empty into Salt lake, besides many large creeks and numerous smaller ones.

Salt lake is about 120 miles long, north and south, and 40 miles wide, and contains several islands of considerable size, some of which are partially covered with timber. A steamer is now being built for the purpose of shipping the timber from these islands, for the use of Salt Lake City.

The lake is subject to sudden storms, and boat navigation is sometimes dangerous. Until the present time, no serious effort has been made to test its capabilities for navigation, but there is no doubt that the trade on this lake will, at some future period, be of considerable magnitude. The water is extremely salt. An analysis shows that it contains over 22 per cent. of solid matter, an indication that it has had no outlet to the sea for a great length of time, and that compared with other regions the fall of rain in this part of the country is less, and the evaporation greater, than elsewhere. The ocean represents the average saline impregnation of the world produced by rainfall and evaporation. By comparison with this standard solution we can judge which is in greatest excess, rainfall or evaporation. On the hills which surround Salt lake are marks of an ancient beach about 300 feet above its present level. From the depth to which these shore-marks have worn into the rocky sides of the hills, and the large amounts of debris brought down by streams and deposited at that elevation, it is evident that this level of the lake must have remained for a long period. It is probable the lake once had an outlet to the ocean; and from the fresh-water tertiary fossils found at Bear river, and at other points, it is almost certain that it then contained fresh water. Then, also, it doubtless contained many varieties of fish, but as the water grew salt, they gradually perished; and, so far as has been observed, it has no animal life in it at present.

The cause of the extreme aridity of this country lies in the fact that it is surrounded by high mountains. The Sierra Nevada on the west, the Wasatch range on the south and east, and the Rocky mountains on the north, completely encircle it. The wind coming from any quarter has its moisture absorbed in passing over the mountains.* The absence of vegetation, the effect of this extreme aridity, also aggravates the droughts. The cultivation of these valleys by covering them with crops and trees, may cause some change in the amount of rain-fall, and it is not unlikely that in the course of years the water in Salt lake will be permanently higher than it is now. As the small rain-fall at present is due to the environment of mountains, the inference is that in former times they did not exist, and that this lake is older than the mountains; this conclusion appears to be warranted by our present knowledge of the facts.

The course of the wind in past ages was mainly from the west, as it is now. This is shown by the deeper shore-marks found on the eastern side of the lake—a fact general in Utah and Nevada and the southeastern portion of California.

Utah lake, the source of the Jordan, is almost the shape of a right-angled triangle, about 30 miles long and 20 wide. The water is fresh.

There are several other lakes, as Little Salt lake, Sevier lake, and Goshoat.

The first settlement in this Territory was in 1846, at Salt Lake City, by a band of Mormons. Owing to the fertility of the soil and other natural advantages, the growth of this community has been very rapid for a population devoted to agriculture. The discovery of gold in California and the large emigration which it induced, passing through this place, greatly stimulated trade and made a market for the surplus produce of the inhabitants. The advent of the United States troops under Colonel Johnson, and the discovery of silver in Nevada, and of gold in Idaho and Montana, produced similar results.

These markets are now nearly or quite closed, and trade in the Territory is more depressed than since 1850. This may cause the people to turn their attention to mining, a pursuit hitherto neglected owing to the greater profits derived from agriculture. The favorable notice taken of the recent discoveries of mines on the east side of Green river is evidence in point. The most potent cause of the increase of the population is the encouragement extended to emigration from foreign countries. Nearly nine-tenths of the adult population are of foreign birth. Salt Lake City has a population of about 19,000 inhabitants. It is a beautifully laid-out town. The streets are wide, with streams of clear water running on each side. The carriage-ways are separated from the sidewalks by rows of trees, which present a refreshing appearance in summer to the way-worn traveller who has crossed the deserts. The private houses, built chiefly of wood, are perishable, but the public edifices are constructed of stone and wood, and are durable and highly creditable to the skill and enterprise of the inhabitants. The tabernacle, the principal place of worship, is capable of seating 10,000 people. The width of the streets, the umbrageous rows of trees, the great number of orchards and gardens in the heart of the city, and the incombustible nature of the houses, give a country appearance to the city, and render fires almost unknown. The small size of the farms is favorable to high cultivation. As a consequence, the greater part of Salt Lake valley is under better cultivation than any region west of the Rocky mountains, except, perhaps, around the bay of San Francisco.

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* Lorin Blodget, in his Report on the Climatology of the United States, says: "The Basin region as a whole can hardly be said to be one of periodical rains north of the 35th parallel, however deficient the quantity is, and however abortive—as it may be said—the rains are, as regards vegetation and practical climatology. The rain of summer, from the middle of June forward, is practically valueless in cultivation for the vicinity of Great Salt Lake, and the flourishing settlements there are sustained by irrigation. Cultivation would clearly require this aid everywhere, and as the winters are not available in bringing crops forward as in California, irrigation may not be dispensed with as it may be there. It is unimportant to many of the best crops of California, wheat among them, that there is no rain whatever in summer,[a] since they are so far advanced in the mild winter that the summer is only requisite to ripen them. But in no part of the Basin is this adaptation practicable, so far as known. The extent of summer required is similar to that of like latitudes in the Atlantic States, and the deficiency of rain therefore is destructive, if irrigation is impracticable."

[a] Except on the seacoast north of Mendocino City; from which point occasional summer rains prevail, increasing in frequency towards the north.—J. R. B.

The system of irrigation is excellent and extensive. Farmers in the eastern States might learn much here that would be valuable to them. From a report of the Deseret Agricultural Society of January 11, 1866, it appears that "there have been constructed 277 main canals, in length amounting to 1,043 miles, 102 rods, at a mean width of 5 feet 6 inches, and a mean depth of 2 feet 2 inches, which water 153,949 acres of land, at a cost of $1,766,939, and that there is in course of construction canals at an estimated cost of $900,000."

Ogden is a flourishing town on the east side of the lake, and ranks next to Salt Lake City in population and importance.

SECTION II.

MINES AND MINING.

In the spur of the Wasatch, on the east side of Salt lake, gold has been found in very minute quantities. Some of the quartz assayed about $2 per ton. The mountains at this point trend west of north and east of south. The country rock is granite, and quartz is abundant.

The thermal springs in this vicinity show the presence of sulphate of iron, and possibly mines of value may be found in this spur of the mountain.

MINERSVILLE.—The western part of the territory, adjoining Nevada, so far as known, is the richest in metals. At Minersville are mines of lead and copper, which contain some gold and silver. One of the mines has been worked to a depth of 90 feet. At this point the copper predominated, and the working of the mine for lead was suspended. The lead was smelted to supply the territory. While lead prevailed working of the mine was remunerative. No effort was made to recover the silver, although in many countries this would have been profitable. By opening the mine at other points, no doubt lead ore of the same quality as that worked could be obtained. The percentage of silver contained in the lead and copper ores of this district is sufficient to justify the conclusion that the working of these mines will be a source of profit at some future day.

RUSH VALLEY.—This district abounds in veins containing argentiferous galena and copper. In 1865 there was considerable excitement about these mines. Companies were organized by officers of the army at Salt Lake City, and some developments were made. Smelting works were erected at the mines, but the smelting failed to extract the metal in a satisfactory manner, and the expenses incident to enterprises of this kind, in a new country, rendered operations very costly. Silver occurs in galena in the same irregular manner as in quartz. Many suppose that if a vein of galena assays well in one part it will do the same in all; an erroneous idea, as miners frequently find to their cost. When transportation is cheaper, fuel more abundant, and labor cheaper, these mines will doubtless be valuable. At present no profit is likely to be derived from working them.

COAL.—The eastern part of the territory contains large seams of coal. As it has been found as far south as Pahranagat and at San Pete, it is not improbable it abounds in many parts of the Green River valley. That said to be from San Pete is a firm bituminous coal, considered by many superior to any found west of the Rocky mountains, but its quality must be thoroughly proved in large amounts before it can be pronounced equal to the bituminous coal of Pennsylvania.

The coal from Pahranagat is found about 300 miles southwest from Salt Lake City; that from San Pete 120 miles south. About 80 miles east from the city coal is found very abundantly. These discoveries tend to justify the conclusion that coal exists in large quantities in the Territory. As soon as a market is opened, the demand can be supplied from these coal fields. Owing to the scarcity of fuel in the mining regions of the eastern part of Nevada and the western part of Utah, where most of the silver, copper, and lead ores must be smelted, coal will in time be in great demand.

Anthracite.—The most interesting discovery in this connection is anthracite coal. Scientific men have long been seeking in vain to find anthracite west of the Rocky mountains. It has recently been found on Green river. An old iron-worker from the anthracite regions of Pennsylvania says the deposit is identically the same. The coal is heavy, and will not burn with a flame. When used in a blacksmith's forge it gives an intense heat. This article has been tried and found to answer all the purposes required of it.

PACIFIC RAILROAD.—The advantages to be derived from the construction of the Pacific railroad will be beyond computation. Branch railroads will follow, and these coal fields will eventually be opened up. The number of coal seams visible along the cañons in eastern Utah is remarkable. Many of them are of large size; some are said to be 15 feet thick. Occasionally they can be traced four or five miles. They are so numerous and easily found that the inhabitants do not locate them. It would be difficult to imagine such an abundance of valuable coal deposits in Nevada or California as to preclude location. Utah appears to be nearly in its normal condition. The recent elevations and depressions are slight; consequently in mining for coal it is probable few faults will be found. The great number of veins near the surface will furnish that article for years to come without deep mining or the use of expensive machinery for hoisting or pumping. If the coal fields on Green river should prove as extensive and of as good quality as there is reason to expect, it will be a great advantage to the miners on the Colorado and at Pahranagat, as well as useful in the navigation of the Colorado river. A thorough exploration of the coal fields of Utah, Dakota, Colorado, and Montana is much needed. It would probably establish the fact that western coal fields, though inferior in quality, rival in extent the vast deposits east of the Mississippi river.

IRON.—Iron ore is abundant in Utah. Attempts have been made to smelt it, but so far without success. There is nothing refractory in this ore to render smelting difficult with skill and the proper appliances. The demand for iron will always be large in Utah, and the cost of freight from any other point of production renders it an important resource for development. With a large agricultural population, labor will be cheap. In every point of view Utah appears to have better facilities for the production of iron than any of the adjoining States or Territories. The profit on agricultural pursuits will become less every year, for many years to come. All the adjacent mining States and Territories will soon raise their own stock and grain. With the exception of New Mexico and Arizona they are now doing it to a great extent, so that there will be only a home market for the produce of Utah. This will have a tendency to turn the attention of the inhabitants to mining and manufactures. In the latter branch of industry they are already actively engaged.

SALT.—Salt can be produced in unlimited quantities, both for home consumption and export. When the railroad is completed it will probably pay to transport this article to the markets of the Atlantic. In the State of Nevada salt is so cheap and abundant that it will not pay to send it west from Utah.

SODA exists in vast beds in many parts of the Territory. When labor and freight are cheaper this will probably be an article of export.

Cottonwood Cañon is about 27 miles southeast from Salt Lake City, in the Wasatch mountains. It contains several silver mines. A Mr. Hirst is running two furnaces there at present. They are not on an extensive scale, but the results are satisfactory. Hirst thinks his ore will yield $200 to the ton. He has a German to manage his works, who is reputed to be skilful. The veins occur in limestone, and ore exists at the surface in abundance. This is a valuable lead-mining district. The ore is remarkably free from antimony.

General Conclusions.—The Territory of Utah will undoubtedly become in time an important and prosperous State. It possesses a great variety of resources. Whatever may be the opinions entertained as to the peculiar institutions existing there at present, none can deny that its population is industrious and enterprising. A people who have redeemed the deserts by a vast system of irrigation, built up cities, inaugurated an excellent school system, established manufactures of nearly all the articles necessary for the use of man, opened up roads in every direction, and supplied the miners of the adjacent Territories for several years with their products, cannot fail to achieve a condition of high prosperity in the future. Contact with their neighbors, who entertain views antagonistic to their social institutions, will remedy the evils under which they now labor. As they become more intelligent the impolicy of isolating themselves from the moral sympathies of the world will become apparent, and their patience, industry, and self-reliance will be turned to good account.

MONTANA.

SECTION I.

AREA AND POPULATION—MOUNTAINS AND VALLEYS—GEOLOGICAL FEATURES—VEGETABLE PRODUCTIONS AND AGRICULTURAL LANDS—TIMBER CLIMATE, AND NAVIGABLE WATERS.

Montana, the most recently organized of the Territories of the United States, is second only to California in the production of gold. Embracing within its limits the range of the Rocky Mountains and the heads of two of the greatest rivers that wind their long and devious courses through the lower countries to the Pacific and Atlantic oceans, this Territory may justly claim the appellation of the "Golden Summit." Extending from the 45th to the 49th parallel of north latitude, and from the 27th to the 39th meridian west from Washington, it contains an area, according to the report of the Commissioner of the General Land Office, of 143,776 square miles, (92,016,640 acres,) bounded by meridians and parallels of latitude, except a portion of the southwestern corner, where for the distance of nearly 400 miles the boundary follows the crest of the Bitter Root mountains. The population is about 32,000.*

MOUNTAINS.—In this Territory the most striking geographical feature is the great range of the Rocky mountains, extending 350 miles from its southern to its northern boundary, and in width over 200 miles. This range, with its spurs, occupies fully half the Territory. The main chain of mountains is split up into a number of different ranges, as the Bitter Root, which is the highest and the

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* Langley, in his Pacific Coast Directory, a publication generally accurate, estimates the population as follows:

Table exhibiting the principal cities and towns of Montana Territory, the county in which each is located, the estimated population in September, 1866, and the distance from Virginia City, the territorial capital.

Town.	County.	No. of miles from Virginia City.		Estimated population.
Bannack City	Beaver Head	70½	W.	800
Benton City	Choteau	400	N. W.	1,500
Blackfoot City	Deer Lodge	200	N. W.	2,000
Deer Lodge City	do	80	N. W.	1.500
Reynolds City	do	180	N. W.	2,000
Silver Bow	do	100	W.	1,250
Helena	Edgarton	125	N.	8,000
Bozeman	Gallatin	60	E.	290
Dennison	do	155	N. E.	1. 500
Gallatin City	do	100	N. E.	500
Prickly Pear	Jefferson	90	N.	250
Nevada City	Madison	2	N. W.	2 000
Stirling City	do	30	E.	500
Summit City	do	8	S.	1,000
Virginia City	do			4,000
Diamond City	Meagher	165	N. E.	2,000
Missoula Mills	Missoula	150	W.	500
Total				29,500

The surveyor general of the Territory, in his report of 1867, makes the following estimate: "I may be safe in estimating the entire population at 40,000, and it is confidently believed that it will reach 60,000 in 1868 should there be no Indian troubles along the overland routes. * * * The class of citizens who are coming into the Territory are generally those who intend making it their homes. Hence many families are coming and settling up the different valleys. The farming population is fast increasing, and a great number of miners find it profitable to devote their time to agriculture."

The reports of the county assessors for 1865 and 1866 do not warrant the belief that the increase has been so rapid. My opinion is the population at this time does not exceed 32,000.—J. R. B.

most westerly, and the Rocky, Wind River, Big Horn, and Belt ranges. All of these have a trend northwest and southeast, and all contain mines of gold and silver. Their height has not been determined, but it is probably from 10,000 to 14,000 feet, the highest peak being covered with perpetual snow. This great extent of mountain ranges causes the condensation of a large amount of moisture from the atmosphere, which falls principally in the form of snow. Gradually melting during the warm season, it thoroughly saturates the earth, inducing a fine growth of grass and timber throughout the mountain regions.[*]

The Territory is divided by these ranges into a number of basins, and their spurs subdivide each basin into a number of valleys, which contain nearly all the towns and settlements, and the greater part of its agricultural as well as nearly all its mineral resources. The mountains are greatly abraded by the agencies of rains, frosts, and glacial action, leaving them smooth and much less rocky and precipitous than the Cascade range in Oregon, or the Sierra Nevada in California. The Bitter Root is the most rugged and continuous in its height. The other ranges are full of low passes, with none of those lofty peaks that are found farther south in Colorado.

All the mountains appear to be old and weather-worn, and almost at the very summits of the highest ranges beds of gravel containing placer gold have been formed from the disintegration of the neighboring peaks. Thus placer mines are found on the mountain top, differing in this respect from the Sierra Nevadas, where placer gold is almost invariably found in the foot-hills. In the northern part of the Territory the mountain regions have been prospected only sufficiently to prove the existence of gold. The hostility of the Indians has prevented a thorough exploration, or any permanent working of the mineral deposits.[†]

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[*] The following from Lewis and Clarke's Narrative describes the country westward from the main ridge of the Bitter Root mountains. It is applicable to a large area of Montana:

"The country along the Rocky mountains for several hundred miles in length, and about 50 wide, is a high level plain, in all its parts extremely fertile, and in many places covered with a growth of tall, long-leaved pine. This plain is chiefly interrupted near the streams of water, where the hills are steep and lofty, but the soil is good, being unincumbered by much stone, and possesses more timber than the level country. Under shelter of these hills the bottom lands skirt the margin of the rivers, and though narrow and confined, are still fertile and rarely inundated. Nearly the whole of this wide-spread tract is covered with a profusion of grass and plants which are at this time as high as the knees. Among these are a variety of esculent roots, acquired without much difficulty, and yielding not only a nutritious but a very agreeable food. The air is pure and dry, the climate quite as mild if not milder than the same parallel of latitude in the Atlantic States, and must be equally healthy, for all the disorders which we have witnessed may fairly be imputed more to the nature of the diet than to any intemperance of climate."

[†] Professor G. C. Swallow, formerly State geologist of Missouri, says, in a late letter to Governor Smith:

"Veins of gold, silver, copper, and lead have been found in great numbers in nearly all the explored mountainous portions of the Territory; and placer gold is as widely distributed. Many of the gulches have proved vastly rich, and some of them very extensive. So far as discovered, these veins come to the surface on the foot-hills, and on the sides of the valleys and canons; and some of them cut the mountains to their very tops. A large portion of the lodes are true veins, cutting through granite, syenite porphyry, trap, gneiss, mica slate, hornblende slate, talcose slate, argillaceous slate, sandstone, and limestone. These lodes vary in thickness from a mere line to 50 and 60 feet. The gangue or vein rock, called *quartz* by the miner, is very variable in character. In the gold-bearing lodes it is usually whitish quartz, more or less ferruginous, often nearly all iron. In some veins it resembles a stratified quartzite; in a few it is syenitic, pyrites, hornblende, calc spar, arsenic, antimony, copper. Tellurium and micaceous iron are found in these veins. In the silver lodes the iron, so abundant in the gold veins, is often replaced by the oxide of manganese. This mineral is sometimes so abundant as to constitute a large portion of the gangue.

"The gangue, in many of the copper veins, is made up of quartz, heavy spar, calc spar, brown spar, and oxides of iron. Many thousand lodes of gold, silver, and copper have been already discovered and recorded, and many of them more or less developed. It is true here, as well as in all other mining districts, that a large part of the lodes discovered cannot be profitably worked by the methods usually adopted in new mining regions; but many of those which cannot now be worked with profitable results will become valuable when experience has proved the best methods, and when labor and materials can be had at ordinary prices."

The geology of Montana is almost entirely unknown. The Rocky mountains are chiefly composed of granite, gneiss, and synite, and may be pretty certainly assigned to the Arzoic. Captain John Mullan gives the following general description of the mountain ranges and their geological formation:

> Looking back upon our route, we saw we had followed Bitter Root river to its head, which we found from its mouth to be 95 miles long, flowing through a wide and beautiful valley, whose soil is fertile and productive, well timbered with the pine and cottonwood, but whose chief characteristic and capability is that of grazing large herds of cattle, and affording excellent mill sites along the numerous streams flowing from the mountains. The country thence is watered by tributaries to the Missouri and its fork, to the range of mountains separating these waters from those of the Snake river, or the south branch of Lewis' fork of the Columbia, and is also fertile, but its characteristic feature is the great scarcity of timber for any purpose, the willow and wild sage being used for fuel along the whole route. The geological formation of this section belongs to the tertiary period. The capability of this broad area, however, for grazing is excellent. * * * The whole country is formed of a series of beds of mountainous ranges or ridges, with their intervening valleys, all of which are well defined and marked, the decomposition and washings of the rocks of the mountains giving character to the soil of the valleys, which may be termed, as a general thing, fertile. The geological formations along the Jefferson fork and its principal tributaries are limestone and conglomerate rock. From the range called the Snake river divide, the whole character of the country is completely changed. Here the geological formation is basaltic and volcanic principally. None of the numerous streams and rivulets flowing from the mountains along the route we travelled emptied into the Snake river, but either sunk into the ground or formed small lakes in the broad valley of Snake river. The ground in most places is formed principally of sand, and where large beds of basalt are not found, the ground is of a dry, absorbing nature, through which the water sinks, at times bursting out again. It was somewhat singular that, for 60 miles above Fort Hall, along the main stream of Snake river, we did not cross but one tributary, and that coming in from the south, while none came in from the north; all of the streams, as before mentioned, either forming lakes or sinking into the ground. This section is also noted for the great scarcity of timber, and the immense plains of wild sage, which is so abundant that it merits the name of the sage desert of the mountain. It extends for many miles in length and breadth, forming an immense ocean of prairie, whose sameness is only broken by the "Three Buttes" of the valley, which rise like islands in the sea in this broad and barren area. (Report on the construction of a military road from Fort Walla-Walla to Fort Benton.)

VEGETABLE PRODUCTS.—In the fertile soil of the valleys wheat, barley, and oats grow well, and good crops are produced. Rye and buckwheat would also flourish, but Indian corn would probably fail.* Potatoes grow in the greatest

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There are, however, a very large number of large and rich lodes which will yield large profits even at the present prices of labor and materials. Some of the lodes of both gold and silver will rank among the largest and richest in the annals of mining. In regard to the want of success in some of the mining operations in the Territory, it may be said that such partial failures are incident to all mining regions, particularly in the early operations of new regions. Montana is particularly exposed to delays of success from its remoteness from machine shops, where the machinery used may be altered and repaired to suit the exigencies constantly arising. But all these hindrances to immediate and full success in quartz mining operations will soon be removed. They are obvious to all acquainted with the business, and are such as will naturally pass away. Better mills are being put up, better lodes are bought in larger quantities, better management is secured, and the owners of quartz property are offering better facilities to those who wish to work their mines; capital is seeking this source of wealth, and good financiers are operating in Montana mining property. The placer mines are not yielding so much as at some former periods. Many new localities have been discovered, and large sums have been expended in conducting water to favored localities, and there is every reason to believe that the placers will, the coming year, yield many more millions to the hardy toilers who have labored so faithfully and successfully in securing this "golden harvest" The quartz mining operations are now in a better condition to secure success than ever before, and the men who have discovered and partially developed the silver, gold, and copper lodes, have been long inured to disappointments and hardships, and will not yield to any ordinary obstacles; and we may safely believe that 10,000 of such earnest, skilful, hardy men will achieve magnificent results in such a field as the mines of Montana present.

*Professor Swallow says: "The results already obtained from herding and the cultivation of our own rich valleys are such as to remove every reasonable doubt of the entire success of agricultural pursuits in the Territory. It certainly is one of the finest stock countries on the continent. All the more important domestic animals and fowls do remarkably well. Horses and mules and neat cattle are more hardy and kept in better condition on the native grasses, hay and grain. As a general rule they winter well in the valleys and perfection, and their flavor if not superior is equal to that of any in America. The residents of Montana believe that their potatoes are superior in dryness and mealiness to any in the world, Ireland and California not excepted. Beets, peas, onions, cabbages, cucumbers, radishes, parsnips and turnips grow finely, while in the warmest valleys melons and tomatoes come to maturity. Bitter-root, a small plant flowering in June—the root three inches long, one-fourth inch in diameter, and very often forked—grows in many of the Rocky mountain valleys, and is very abundant in Bitter Root valley. It is a favorite article of food for the Flathead Indians, who dig it in May, and dry it so that it will keep for years. Very nutritious, but extremely bitter.

Camus, as an article of food for the Indians, is probably the most important of the wild plants. It is abundant in all the northern parts of the Pacific coast. It is a bulbous root, about an inch and a half in diameter, and grows in low, swampy lands, having a sweet gummy taste, and is very nutritious. Besides using it largely when fresh, the Indians boil it and afterwards dry it, so as to preserve it for years. If cultivated it might become a valuable culinary vegetable.

Qullah is another singular article of food used by the Indians. It is the root of a plant about the size of a man's finger, of a deep yellow color, growing in the moist land along the banks of the streams. When raw it is poisonous, but when cooked in a kiln, a process occupying several days, it turns to a black color and resembles tobacco in taste and smell, and is equally offensive to people not accustomed to it.[*]

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on the surrounding foot-hills without hay or grain. The valleys furnish a large area of natural meadows, whose products are equal in quantity and quality to those of the cultivated meadows of the middle States. Beef, fattened on the native pastures, is certainly not inferior to the best produced in the country. The small grains, wheat, rye, barley and oats, produce as large an average yield as in the most favored grain-producing States. Of the native fruits, we have choke cherries, service berries, currants, gooseberries, blueberries, raspberries, and strawberries can be cultivated as successfully as in the New England States.

"All the more important root crops, such as potatoes, turnips, rutabagas, beets, carrots, parsnips, radishes, and onions, and the most valuable garden vegetables, are cultivated with great success. Timber is abundant on the mountain slopes and in some of the valleys. Five species of pine, two of fir, one of spruce, and two of cedar, grow on the mountains, and in the mountain valleys and cañons; balsam, poplars, aspens, alders, and willows, on the streams and in the moist valleys.

"The pines, firs, spruces, and cedars furnish an abundance of good timber for building, mining, and farming purposes. The purest waters flow everywhere in cool springs, mountain streams, meadow brooks, and clear rapid rivers. Hot and mineral springs also occur in various parts of the Territory. Beautiful lakes and magnificent falls and cascades are numerous in the mountains."

[*] Professor A. K. Eaton, in a recent report to Governor Green Clay Smith, says of the agricultural resources and climate of Montana:

"In a Territory so far removed from the great grain-producing States, the most vital question bearing upon our future welfare is that as to our ability to become self-sustaining in all things pertaining to the necessaries of life. If our success thus far is not a sufficient guarantee of our ability to raise all the cereals, root crops, &c., requisite to support a large number of inhabitants, a consideration of the geological and topographical formation of the country and its climatic characteristics would of itself demonstrate that the soil cannot fail to furnish all that is essential to the subsistence of an unlimited population.

"Our valleys are very broad, ranging from five to fifteen miles in width, and made up of rich bottom lands and level or gently undulating plateaus. The mountain ranges on either side generally differ in their geological character. On one side, granite and its allied primitive rocks, by the disintegration of which valleys have been supplied with the alumina and alkaline silicates so necessary to an inexhaustible soil; on the other, ranges of secondary limestone, sandstone, &c., that have furnished the additional constituents of a soil of unequalled richness. The want of rain to irrigate the lands is the only apparent difficulty, and nature has provided for this in the conformation of the country. Lying, as these plateaus do, nearly level, the mountain streams, which are frequent and never-failing, are readily turned from their courses and made to wind along the base of the foot-hills, upon the outer limits of the table lands, and thence distributed over almost every foot of arable land. This mode of irrigation has its decided advantages over that of the natural rain storms of regions nearer the coast, from the fact that it is wholly under the control of the farmer. In

TIMBER.—Pine is by far the most abundant timber. The next is fir. The cottonwood, which grows on the banks of the streams, is the only other tree, and it is used only for firewood, and occasionally for log houses. Mountain mahogany is the only hard wood that grows in the Territory, and this is only a shrub. None of the valuable hard woods, as hickory, maple, or ash, grow in Montana.

CLIMATE.—The climate of Montana in the mountainous parts is as cold as that of the New England States. It retards, or entirely prevents, placer mining for about half the year; and until quartz mines are opened, so that the miners can be employed during the long winters, they must remain idle much of their time. There are, however, exceptional years. The winter of 1862–'63 was so mild that placer mining was continued with scarcely an interruption the entire year. Snow generally falls to a great depth, so that communication in the higher districts is somewhat irregular and uncertain during the winter. In the valleys, where the altitude is less, the climate is milder. In Deer Lodge and the Gallatin and Madison valleys stock continues in good condition, throughout the year, without hay or grain, the grass being abundant nearly all the time. Montana is a remarkably healthy country. There seems to be no peculiar diseases incident to the climate. In the towns the great majority of deaths are either accidental or the result of violence.*

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a Territory nearly four times as large as the State of New York, we have hundreds of thousands of acres of land of this description, available whenever the growth of the country may demand its cultivation.

"No disquisition, however, is necessary upon the character of the soil or its origin. Facts demonstrate beyond question the self-sustaining character of the Territory in an agricultural point of view. Flour to-day is almost as cheap as in the great grain-producing regions of the east, and this has been brought about by the cultivation of limited patches, here and there, of these broad lands. Our table-lands and the slopes of our foot-hills, without irrigation, furnish the most abundant pasturage; the species of grass flourishing spontaneously being of the most nutritious character, and in some respects superior to the cultivated grasses of the east.

"The peculiarities of our climate demand a passing remark. The great wind currents that start from the distant sea-coast regions laden with moisture, deposit it in beneficent showers on their way, and reach our inland mountain regions with scarcely a drop to moisten our thirsty soil; still this deprivation proves a blessing in disguise. It gives us an atmosphere comparatively free from moisture, and makes our severe winters more endurable than even those of lower latitudes. Our lowlands are often almost free from snow during the whole season, and cattle graze and grow fat on the grasses of our valleys during our long winters.

"The climate is indeed the most pleasant and salubrious of any that I have personally ever known; and this in a country where the altitude of the valleys is about one mile above the level of the sea, and lying between 45° and 49° north latitude."

* Captain Mullan says in his report:

"The temperature of Walla-Walla, in 46°, is similar to that of Washington city, in 38° latitude; that of Clark's Fork, in 48°, to that of St. Joseph, Missouri, in latitude 41°; that of the Bitter Root valley, in 46°, is similar to that of Philadelphia, in latitude 40°, with about the same amount of snow, and, with the exception of a few days of intense cold, about the same average temperature. This condition of facts is not accidental, but arises from the truths of meteorological laws, that are as unvarying as they are wonderful and useful. As early as the winter of 1853, which I spent in these mountains, my attention was called to the mild open region lying between the Deer Lodge valley and Fort Laramie, where the buffalo roamed in millions through the winter, and which, during that season, constituted the great hunting grounds of the Crows, Blackfeet, and other mountain tribes. Upon investigating the peculiarities of the country, I learned from the Indians, and afterwards confirmed by my own explorations, the fact of the existence of an infinite number of hot springs at the headwaters of the Missouri, Columbia, and Yellowstone rivers, and that hot geysers, similar to those of California, existed at the head of the Yellowstone; that this line of hot springs was traced to the Big Horn, where a coal-oil spring, similar in all respects to those worked in western Pennsylvania and Ohio, exists, and where I am sanguine in believing that the whole country is underlaid with immense coal fields. Here, then, was a feature sufficient to create great modifications of climate, not local in its effect, but which even extends for several hundred miles from the Red Buttes, on the Platte, to the plains of the Columbia.

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"A comparison of the altitude of the South pass, with the country on its every side, with

Navigable Waters.—Although Montana is abundantly supplied with rivers carrying large bodies of water, the great altitude of the Territory induces such rapid currents as to prove serious obstacles to navigation. On the western slope the rivers are unnavigable for anything except rafts, small boats, and canoes, their courses being continually interrupted by shoals, rapids, and falls. On the eastern slope, the Missouri has a light-draught steamboat navigation of over 300 miles to Fort Benton, and steamboats have ascended nearly to the Great Falls, situated about 50 miles above. Fort Benton is the depot of supplies for the whole Territory, and even to this point navigation is very uncertain. In dry seasons the water is scant on the shoals, and, as the banks are unsettled, the boats have to be supplied with fuel by cutting wood. In many places wood is very scarce, and has to be carried on the backs of men for a mile or more. Vexatious delays are the result. Every year the wood is getting scarcer and more difficult to procure. The hostility of the Indians also renders navigation perilous at this time.

Coal is found some distance below Fort Benton. When mining for this article is carried on extensively it will probably supply the steamers with a sufficiency of fuel. It is a brown or lignite, probably in the *cretaceous* formation, and is found in veins of large size, traceable in the banks of the streams for long distances.*

Mullan's pass, further to the north, may be useful in this connection. The South pass has an altitude of 7,489 feet above the level of the sea. The Wind River chain, to its north, rises till it attains, at Frémont's peak, an elevation of 13,570 feet, while to the north the mountains increase in altitude till they attain, at Long's peak, an elevation of 15,000 feet; while the plains to the east have an elevation of 6,000 feet, and the mountains to the west, forming the east rim of the great basin, have an elevation of 8,234 feet, and the country between it and the South pass an elevation of 6,234 feet above the level of the sea. The highest point on the road in the Summit line at Mullan's pass has an elevation of 6,000 feet, which is lower by 1,489 feet than the South pass.

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"The high range of the Wind River chain stands as a curvilinear wall to deflect and direct the currents of the atmosphere as they sweep across the continent. (By-the-by, whence arises the name of the Wind River chain?) All their slopes are well located to reflect back the direct rays of the heat of the sun to the valleys that lay at their bases. These valleys, already warm by virtue of the hot springs existing among them, receive this accumulative heat, which, driven by the new currents of cold air from the plains, rises and moves onward in the form of a river towards the valleys of the Rocky mountains, where it joins the milder current from the Pacific and diffuses over the whole region a mild, healthy, invigorating, and useful climate." (Mullan's Report, pp. 53, 54.)

Thermometrical data furnished by J. L. Corbett, civil engineer, Virginia City, Montana.

1865.—Mean reading during the mouth of December	5°.22	above zero.
1866.—Mean reading during the month of January	27°	"
1866.—Mean reading during the month of February	22°	"
Mean during the three months, 18° above zero.		
1866.—Mean during December	31°	"
1867.—Mean during January	23°.73	"
1867.—Mean during February	26°	"

The mean during March, 1867, is unknown, as only the coldest days were registered, which were as follows: March 11, at 7.30 a. m., 0°; at 8.20 a. m., 5°; at 1 p. m., 1°; at 6 p. m., 12°; at 10 p. m., 18°, or below zero. March 12, at 7 a. m., 18°; at 10 a. m., 12°; at 5 p. m., 6°; at 6 p. m., 16°; at 9.15 p. m., 22°. March 13, at 7 a. m., 24°; at 1 p. m., 10°, or above zero; at 10 p. m., 3°, or above zero. Weather moderate afterwards.

Twenty-four degrees below zero is the greatest cold experienced during the past three winters at this place. Mean during the winter months for the past two winters, 22° above zero. Mean of barometer reading, 2,440 inches; altitude, 5,481 feet; boiling point, 202° Fahrenheit; latitude, 45° 27′ 35″; longitude, about 111° 17′.

* The surveyor general of Montana, in his report for 1867, says:

"Bituminous coal has been found on the Big Hole river, about 60 miles from Bannack City; in Jackass gulch, on the east side of the Madison; and at Summit district, near Virginia City, the veins being from three to four feet in width. Coal also exists at the head of the Yellowstone river. Brown coal, or lignite, is found in great quantities on the banks of the Missouri and Yellowstone, valuable as common fuel, but of no great value for manufacturing purposes. It has also been found on the headwaters of the Teton and Marias."

The Yellowstone has not been sufficiently explored to determine its capabilities for navigation; but those best qualified to judge think that, with suitable boats, it may be navigable far higher than boats have yet reached. Indian hostilities and want of population have prevented a more thorough exploration. The rates of freight charged on the steamers from St. Louis to Fort Benton are so high that if a boat makes one trip it sometimes pays all expenses and returns the capital invested in the boat itself. Competition will probably reduce these charges, unless their trade should be closed altogether by the Indians.

The portion of Montana on the western slope forms a basin about 250 miles long and 75 miles wide.* It is drained by the Missoula, Hellgate, Blackfoot, and Flat Head rivers, which uniting, form Clark's Fork of the Columbia river. The extreme northern part is drained by Tobacco river, which empties into Lake Bratham, in Idaho Territory. Flat Head is the only lake of any considerable size in Montana. It is a beautiful sheet of clear water about 35 miles long and 15 broad, surrounded by a fine farming and grazing country. This basin contains the best timber, and probably as good grazing and farming lands as are in the Territory. The valley of the Madison and Gallatin only are equal to it in the latter respect. The warm moist winds from the Pacific induce a more vigorous development of vegetable life than in other parts of the Territory, where the high wall of the Rocky mountains prevents these winds from exercising their influence. In this mild and temperate climate the missionaries established missions for the religious advancement of the Indians. The sites of several of their missions still remain, and are admirably situated in the midst of a fertile country.

From Flat Head lake south, towards the mission of Pen d'Oreille, along the foot of the Rocky mountains, the country is well supplied with timber, water and grass, and is an excellent agricultural district. South of the mission is the Jocko valley, containing the Pen d'Oreille Indian reservation. This is a small rich agricultural valley, which, if properly cultivated, would be very productive.

Hell Gate valley is southeast from the reservation. It is about 25 miles long, and six or seven broad, possessing excellent agricultural resources. Still south is the Bitter Root valley, about 60 miles long and eight wide. In this is Owen's trading post, called Fort Owen, around which is a flourishing settlement.

The Hell Gate and Bitter Root at their junction form the Missoula, which retains that name until it forms a junction with the Flat Head forming Clark's Fork of the Columbia. Hell Gate and Bitter Root valleys contain a number of settlers, and in time will contain a large agricultural population. At this point the Bitter Root mountains present an almost impassable barrier, with but few passes, and can only be traversed in the warmest part of the year; at other seasons they are completely blockaded by the snow.

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*The surveyor general says: "The soil of the valleys and table lands is of good quality, and it is believed that fully one-third of the Territory is susceptible of profitable cultivation. The more important valleys requiring immediate survey are the Bitter Root, Deer Lodge, Hell Gate, Ronde, Big Hole, Beaver Head, Stinking Water, Jefferson, Madison, Gallatin, Boulder, Prickly Pear, (including the town of Helena,) and the Missouri from the Three Forks to Cañon Ferry, east of Helena. The arable lands in these valleys amount, by careful estimate, to 9,000 square miles, and contracts for their surveys will be let as soon as possible. A ready home market is found for the product of the ranches and dairies, and the supply of the different kinds of grain raised is no doubt sufficient for the wants of the population until another crop is produced. The yield of potatoes has been so great during the past season that it is believed that fully 1,000,000 bushels could be exported, and still have enough for home consumption. The wheat raised in Gallatin valley is closely estimated at 8,000 acres, and the other small grains, such as oats, barley, rye, &c., are placed at 6,000 acres. The yield will be at least 30 bushels to the acre, giving us, as a low estimate of all the grain crop in that valley for this year, at 420,000 bushels. The list of the territorial auditor shows 165,140 acres of land under cultivation in the Territory, and the total valuation of the property assessed is $5,703,118. The flouring mills are particularly mentioned. The grazing lands are among the finest in the world, their nutricious grasses serving to keep cattle and stock in good condition during the entire winter. The number of cattle grazing on these lands is estimated at 40 000."

Big Blackfoot comes into Hell Gate river in the cañon of that name, and for 15 miles runs through another cañon. Above, it passes through a large and beautiful valley similar to that of Hell Gate. On the head of this river are some good placer mines. Some say the cañon received this name of "Hell Gate" from the gloomy character of its scenery; others, that it was so named from the fact that the Indians, when on the war path, intent on deeds of blood and rapine, always issued out from it. Either cause would be sufficient.

Flint Creek.—Forty miles above the mouth of the Big Blackfoot, from the south, comes in Flint creek through a fine large valley with plenty of grass, water and timber. Recently near the head of this stream rich silver mines have been found, and a town of 400 or 500 inhabitants has sprung up in a few weeks. On one of the branches of Flint some good placer mines have been discovered which paid well this summer. Twenty miles above this creek the Little Blackfoot comes in from the northeast. For some distance above its mouth is a good grazing country, not suitable for agricultural purposes, but well timbered. The ravines and gulches at the head of this stream contain some good placer mines, and several mining towns have sprung up, such as Blackfoot City and Carpentier's Bar. Quartz veins containing gold have been found in this vicinity, but they have not been sufficiently worked to prove their value.

Deer Lodge Valley.—To the southward lies the Deer Lodge valley, one of the most picturesque and beautiful, as well as one of the richest mineral and agricultural districts in Montana. It is about 35 miles long and 10 broad, surrounded by low rolling hills, which afford excellent pasturage. This favored region, called by the Indians Ttsookeencame, or, translated, "the Deer's Lodge," takes its name from a singular mound in the upper end of the valley composed of silicious and ferruginous depositions, formed by a thermal spring.

This mound is a truncated cone 30 feet in height, 100 feet in diameter at the base and 30 feet at the summit. Brightly colored with white and reddish-brown spots, it forms a notable landmark. In the winter, when the steam rises like smoke from a spring at the top, it bears a striking resemblance to a large Indian lodge. This spring is three feet in diameter and of a considerable depth. The water, which does not overflow at present, is nearly at the boiling point, while at the base of the mound several springs exist the temperature of which varies from near boiling point to icy coldness. A marsh elevated a few feet above the surrounding plains is formed by the springs at the base of the mound. Very few such formations, caused by thermal springs, are found in the Pacific Territories. Hence it must be different from the ordinary methods of deposition. From the fact that the spring in the centre of the cone does not overflow, it is evident that in former times it must have been more active than at present, and that the forces that once gave it activity are failing; also, that unless there is a recurrence of its ancient eruptive power the mound will never rise any higher. Probably it is lower than formerly. Ordinary thermal springs throw quite a volume of water, which, gradually cooling, continues to deposit its sediment for a considerable distance, depositions not being materially greater at the mouth of the springs than 100 or 200 yards distant.

Quite a large number of farms are under enclosure in this valley. Stock raising also employs some of the inhabitants. Until recently there was but little mining in this vicinity. Last spring and summer some very good placer mines were discovered in the hills on the east side of the valley. On Silver Bar, a stream falling into the head of the valley, placer and quartz mines containing gold, silver and copper, especially the latter metal, have been worked for over two years, resulting in the mining towns of Silver Bar and Butte City.

Town of Cottonwood.—Cottonwood, the county-seat of Deer Lodge county, is situated on the north side of Cottonwood creek, near its junction with Deer Lodge creek. It has a good location for a town. The streets are wide and well laid out. The advantage of wide streets in mining towns is so evident, in view of the dangers from fire, that it is singular so few new towns are laid out in this manner. The houses are usually built of wood. Fire engines are the accompaniment of a more advanced progress. When a fire once gets fully under way in these mining towns it seldom stops until it meets an open space.

Cottonwood is a pleasant little town, with that dreamy appearance of repose indicative of an agricultural district. Timber is scarce in the valley, but is abundant in the adjacent hills and mountains. Pine and fir constitute the sole supply.

The scenery here is wonderfully picturesque. Spurs and broken chains of mountains, the lofty summits regularly dispersed, rise above and beyond one another, giving an idea of interminable distance. The rarity of the atmosphere consequent on the altitude causes the rays of light to be less strongly refracted than when the atmosphere is denser, giving a strange and unnatural reflection to every object. The light is peculiar in many respects. While it does not apparently impair vision, it seems to blend in all colors a portion of black. Thus, as the eye follows one mountain peak after another, the color becomes darker and darker, till the most distant are almost entirely black. The color of the snow, varied by increasing distance, goes through the same changes, and at last appears of a dark gray. There are none of those wondrous changes of tints and shadows which are so charming in the lower latitudes as Mount Hood, whose snows from a hundred different points of observation never appear twice of the same color. Here every tint is sombre and rigid, and notwithstanding the beauty of the scenery the mind is chilled with a feeling of awe. This is heightened by the appearance of the low hills, which are covered with grass, and have the aspect of fields once cultivated, but now permitted to return to a state of nature.

In the upper part of the valley, near the hot springs, the snow seldom lies on the ground, and there is an abundance of good pasturage the year round.

A curious and interesting fact connected with this locality is worthy of note. From the head of this valley into Big Hole, or the valley of Divide creek, a branch of Big Hole, is the lowest pass through the Rocky mountains. In fact, it is simply a continuation of one valley into another. At Butte City water is brought from the head of Boulder creek, which is a tributary of the Missouri, through a low pass into Silver Bar, a branch of Deer Lodge creek, thus taking the water from the Atlantic and giving it to the Pacific.

The streams and small lakes which abound in the hills around this valley are well supplied with trout. All the streams on the Pacific slope contain trout; but except in the Yellowstone and its tributaries they are very scarce on the Atlantic slope.

A short distance below Deer Lodge, a small creek empties into Hell Gate river from the west, called Gold creek. It is remarkable as the first place where gold was discovered in Montana. The discovery was made on the banks of a stream whose waters finally flow into the Pacific ocean.

During the present year the mines on the western slope have been much more productive than formerly, while on the eastern slope the production this year will be less than that of last year.

SECTION II.

MINES AND SYSTEMS OF MINING.

Gold was discovered in Montana by a French half-breed, named François Finlay, about the year 1852, on Gold creek, a branch of the Hell Gate river. He was merely prospecting, and did not find the gold in sufficient quantities to induce him to work the mines.*

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* Mr. Albert D. Richardson quotes from a book published in Cincinnati 50 years ago, as follows:

"These mountains are supposed to contain minerals, precious stones, and gold and silver ore. It is but late that they have taken the name Rocky mountains; by all old travellers they are called the Shining mountains, from an infinite number of crystal stones of an amazing size with which they are covered, and which, when the sun shines full upon them, sparkle so as to be seen at a great distance. The same early travellers gave it as their opinion that in future these mountains would be found to contain more riches than those of Indostan and Malabar, or the golden coast of Guinea, or the mines of Peru."

Mr. Richardson remarks:

"These surmises excited little notice, for the early travellers believed every mountain an El Dorado, and every stream a Pactolus. The first statement which appeared worthy of serious attention was made by Colonel William Gilpin of the United States army. This gentleman, a zealous student of the natural sciences, crossed the continent with a party of Oregon explorers, and again with his command during the Mexican war.

"In 1849, in an address at Independence, Missouri, as the result of all his observations, he asserted the abundant existence of gold, silver, and precious stones throughout the Rocky mountains." (Beyond the Mississippi, pp. 135-6.)

Professor A. K. Eaton, in his report to Governor Green Clay Smith, gives the following general summary of the mineral resources of Montana:

"Of the common minerals of value in the arts and manufactures, there seems to be every indication of abundance, although little has been done towards the development of them; fire clay, gypsum and coal are indicated strongly in the tertiary deposits that underlie the table-lands of the valleys and elsewhere; but they lie mostly undisturbed and undiscovered, except where some wandering prospector has accidentally come upon their outcrop. The pursuit of the precious metals has made the people oblivious to all minor considerations; but if we consider, for a moment, the immense advantage that would accrue to the Territory by the opening of reliable coal beds, it would be an incentive to the greatest effort; fuel for our furnaces and manufactures, to say nothing of our ordinary needs, will soon become scarce and dear. I believe that a small appropriation of money for the purpose would insure the discovery and development of coal deposits in a very short time.

"Discoveries of new minerals and ores are occurring frequently in the Territory. Cinnabar, which is of the first importance in a gold and silver-producing region, has been found, though not in place. Specimens of water-worn fragments of this mineral, found in the gulch workings of an almost unoccupied district of the Territory, were recently brought to me, which proved to be of the first quality. This is especially gratifying, since deposits of ores resembling cinnabar have been frequently found, and much useless labor expended in their development. I have also recently, and for the first time, examined true tin ore found within our territorial limits. This also was from gulch working.

"Lead ores occur in profusion, both as galenas and as carbonate of lead, in nearly all districts of the Territory. These will not be worked at present, except when accompanied by silver. All the galenas are so accompanied, and generally in paying quantities of the latter metal.

"Copper lodes are abundant, showing at the surface ores ranging from 15 to 60 per cent. of metallic copper. These when located near the Missouri river may be immediately made profitable. Copper ores in the eastern market probably command to-day about $5 for every per cent. of copper contained; 15 per cent. ore would be worth $75 per ton, and 60 per cent. ore $300. Thus, long before we shall be extensively engaged in smelting these ores, our copper lodes may prove largely remunerative.

"The silver lodes of the Territory which at present attract much attention, are, in part, silver-bearing galenas. These range by practicable working from $20 to $300 per ton. The present cost of labor and fuel precludes the working of the poorer of these ores, but eventually all will be worked profitably. The cost of smelting this class of ores cannot at present be put lower than $35 per ton, and in some localities would exceed this estimate; still there is an abundance of argentiferous galena that can be worked with great profit at the present prices of material and labor. Another class of silver lodes is found in the country which carry no lead or other base metal to interfere with the successful working of the ores by amalgamation. It is from this class of ores probably that the first remunerative results will be obtained, owing to the simplicity of the machinery required. Mills are now being

In 1856 other prospectors found gold at the same mines, but did not work them. In the fall of 1860 the Brothers Stuart & Co. prospected near the same place, and in 1861 and 1862 commenced working in earnest with sluices. This was the first regular placer mining in the Territory. In 1861 they wrote to some

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erected for working ores of this character. The great abundance of veins of this nature of the most promising appearance justifies the expectation that a short time will show large returns of bullion from this source.

"The placer mines of the Territory which have thus far been successfully worked, are those only which from their favorable location with reference to water, &c., could be easily worked without the previous expenditure of capital by single workmen or by small parties. Gulches already worked out by this wasteful method will be reworked perhaps as remuneratively as at first, by the aid of capital. Ditches for the further supply of water, bed-rock flumes, and hydraulic apparatus are essential to the successful working of the majority of our gulch deposits, and when capital flows in that direction, many thousand acres can be worked most profitably, which, to-day, individual effort cannot touch successfully.

"That which has proven one of the most serious obstacles to successful mining in the Territory has been the profusion of gold-bearing veins, showing temptingly at the surface. Nature is never so lavish as she in this case appears, and in the light of general mining experience, we have no right to expect more than a small percentage of true, strong and uniformly rich veins from this great surface display. Thus it is that several failures may precede one great success in the development of mines. There can be no doubt in the mind of any one, making the country a careful study, of the boundless wealth that is hidden in its bosom. Indefatigable energy and untiring perseverance will alone reveal its full magnitude.

"A large number of mills for the working of gold ores have been erected in the Territory, and few of them with more than partial success. The reason is obvious, and in their partial failure, mining history only reflects itself. Some of them are of that untried character of which it may be said that whilst they show in construction some new features and some good ones, unfortunately the new things are not good, and the good points are not new. Novel inventions, even if capable of success elsewhere, are inevitably destined to failure in a new country. The principal difficulty, however, has been the imperfect management of these different enterprises, arising sometimes from the incapacity of agents, but more frequently from the impossibility of anticipating in a country new and undeveloped the exact requirements of the case. One great error has been made by almost all. It has arisen from the over-sanguine belief that quartz could be mined in quantity without preliminary expense in development. The mills are erected, the money and patience of the proprietors exhausted, and with untold wealth the machinery is left to rust and rot for want of ore. To-day nearly every mill in the Territory could be worked most profitably by the expenditure of a few thousand dollars in the thorough opening of the mines belonging to them. Excuse me, sir, for referring to the embarrassments under which we are laboring. It is only by looking our errors in the face that we can find the way to success. It is the fourth year of my residence in the Territory, and I can assure you that my confidence in its great mineral wealth is stronger than ever, and notwithstanding the discouragements that we have been compelled to meet, we may say with pride that no new Territory has made such rapid advances in so short a time as this. The working of many thousands of tons of gold ore in different parts of the Territory, varying from $15 to $75 per ton by active working, is a sufficient indication of the probable average of our gold-bearing rock. The lowest of these limits pays a profit even at the present price of labor in a mill of any considerable capacity. The expense of the importation of machinery has diminished to almost half since the first mills were erected here. The Union Pacific railroad is every day bringing us near to the sources from which we draw machinery and capital. Foundries and machine shops are springing up in our midst, and we are in all directions fast becoming self-sustaining. With agricultural resources unexcelled, with a climate most inviting, with mineral wealth inexhaustible, we may, with reason, feel assured that Montana will take the highest rank among the gold and silver-producing States."

The surveyor general in his report for 1867, says:

"When provisions and labor become cheaper, many gulches will be worked which are at present untouched. Large amounts of money have been expended this season in the construction of ditches, and in preparations for gulch mining next year. The result of these preparations will be that, during 1868, fully 50 per cent. more gold will be taken out than there has been this season. The production of gold for this season has been estimated at $20,000,000, and still not a tenth part of the Territory has yet been prospected.

"Iron has been found on Jackass creek.

"Copper abounds principally in the vicinity of the Musclesbell river. The width of the veins is from three to four feet. Placer copper has been found on Beaver creek, near Jefferson City, which shows some splendid specimens.

"The leads of Montana are generally better defined than in any other mining country in the world, and the singular freaks sometimes taken by them in other regions are less frequent here."

of their friends in Colorado in reference to their prospects and hopes, and induced quite a number of adventurers to come to Montana in the spring of 1862.

The mines on Gold creek not promising as rich as was expected, the Stuarts and others began to prospect the country extensively, and that summer found some mines on a gulch at the head of the Big Hole, which, however, were not very productive. Early in the same summer the mines at Bannock on Grasshopper creek were discovered. These were so rich and extensive that the other mines were abandoned, and by the fall of 1862 nearly all the miners in the Territory, numbering about 1,000, had congregated at this place.

BANNOCK PLACERS.—The Placer mines of Bannock are found on the banks and in the bed of Grasshopper creek, and extend from the town down the creek for a distance of seven or eight miles. They paid well at first; as the creek had an abundance of water, they could be worked by miners with great facility.

The banks appear to be nearly exhausted now; but the bed of the creek, if flumed and worked in a proper manner, would still yield largely. A few miles south from Bannock, near Horn Prairie, are extensive flats and gulches, which prospect fairly. When supplied with water, which will be brought in this fall, they will give employment to a large number of miners.

There are 200 or 300 miners in this vicinity, working at various points in the creek and its banks, probably making something over wages, viz: $5 a day in gold.

In working in the bed of the creek there does not seem to be any concert of action, so as to enable one individual or company to take advantage of the works of another. Each operation is carried on by itself. After one company has put a dam in the creek, and turned the water into a flume, the next company below can take the water at the end of the flume much more easily than the first obtained it. When one claim is drained so as to be workable, the next below will be drier and more easily worked than if nothing had been done above.

BANNOCK QUARTZ.—The first quartz veins worked in the Territory were in Bannock.

Grasshopper creek heads at the foot of a large smooth mountain, called Bald mountain, which abounds in veins containing gold, silver, and copper. The creek then runs eastwardly through a basin, when its branches, concentrating, pass out through a limestone cañon. At the head of this cañon are quartz veins containing free gold, These veins are the source from which the placer mines on the creek were supplied. No gold is found above the veins. The croppings being prominent and conspicuous, were soon discovered and quartz claims located.

In the winter of 1862-'63, two men, named Allen and Arnold, put up the first quartz mill. It was entirely of home manufacture; the irons were obtained from old wagons and fashioned in a blacksmith's shop; all the lumber used, except pine, fir, and cottonwood, came from the same source. The mill had six stamps of 400 pounds each, and was driven by water. The men who built it ran it. In a financial point of view it was a success. The ores were from the discovery claim of the Dakota, and No. 6 of the same lode.

A number of mines in this vicinity were sold to parties in the eastern States, who have expended considerable sums of money and erected several large and costly mills.

In the fall of 1864 the first steam stamp mills commenced working at Bannock. They were only moderately successful in extracting the gold. The men who had charge were practically unacquainted with the business, and generally, as soon as they had learned to manage with more skill, they were superseded by others without experience and the same process repeated.

One furnace was erected which only ran a short time. It is now being rebuilt. The probability is it will only continue in operation as long as the ores are susceptible of reduction more cheaply by smelting than by roasting and amalgamating.

The mines of Bannock have produced a large amount of ore. With proper management they would continue to pay well. A captain ignorant of his business, with a crew of landsmen, can manage a ship as well as a superintendent unacquainted with mining can manage a mine or mill with men unaccustomed to either.

Sulphuret ores have been reached in some of the mines, which the mills will not be able to reduce without additional and proper machinery.

The Dakota.—The Dakota was the first lode discovered and has been worked most extensively, probably more than all other veins in the district. It is a large, irregular vein, distinctly traced on the surface for over a mile in length, and opened at six different points to a depth of 100 feet, and in one place to the depth of 320 feet. There is no doubt of its depth and permanency. It varies in thickness from three to eight feet; dips to the northeast; strike, northwest and southeast; the general dip and strike of the veins in this locality. It carries the oxidized ores to a great depth, containing free gold, easy of extraction.

The Dakota was located under the old law, which only allowed 100 feet to a claim. Nearly every claim was held separately, which materially interfered with the proper opening and working of the mines. One tunnel has been driven in 800 feet in a thorough and workmanlike manner. Some of the shafts are well constructed, but much of the work is poorly done and on a bad system, rendered necessary in part by the small size of the claims. Each company should own at least 1,000 feet, which would justify opening in a proper manner.

The country rock enclosing the lodes is limestone, of a late geological epoch, and rests unconformably upon syenites. No veins have been found in the syenites, and probably if they pass from the limestone into the syenites they will be found to be impoverished.

Argenta.—Argenta mining district lies north from Bannock on the north bank of the Rattlesnake creek. This district, although not large, contains a great number of veins. In no part of Montana yet explored have as many veins been found in so small a compass. On the creek a few small spots have been worked for placer gold.

The quartz veins are in limestone and greatly resemble those at Bannock, only they contain more lead and iron.

The hill on the north side of the creek and opposite the town is a perfet network of veins, which are very irregular, and many of them when followed down are found broken and the continuation lost.

A shaft sunk on this hill is almost sure to strike a blind ledge or a portion of some ledge that crops to the surface in some other location.

The proper way to work these mines is by vertical shafts. A large amount of ground should be owned by one company. The great number of claim-holders in a small space, with the irregular and uncertain nature of the veins, will cause many conflicts of opinion, if nothing more, should an attempt be made to work them separately under each location. The whole hill appears to be full of bunches or pockets of ore, irregularly dispersed. To extract them will require a complicated system of mining operations.

Further west the veins are larger, better defined, and not so numerous. Some of them contain much richer ore.

The **Legal Tender** has been opened to a greater extent than any other in this district. It is irregular in size and rather small, but the ore is rich and contains a large amount of lead, which renders it excellent for smelting.

The **Stapleton** is a good vein and will yield a considerable amount of ore. It contains but little lead. The ore is well calculated for amalgamation.

The **Tuscarora** is situated in a small hill or knoll. At the surface it displays a vast amount of carbonate and oxide of lead. The ore is not very rich in silver, but as a lead mine it may prove valuable.

The smelting works erected by the St. Louis and Montana Company, for a pioneer enterprise, are well constructed, and in a metallurgical point of view their present operations are eminently successful. Whether the financial view is as flattering is unknown. The company wisely conduct their own business.

In this country where all articles are so dear, and skilled labor scarcely to be had, the cost of smelting is very great. Unless the ore is very rich no profit will accrue.

The ore from a few mines in this district must be smelted, as it contains a large amount of lead, but probably nine-tenths of the ore can be reduced more profitably by amalgamation. Much of it would pay well if worked judiciously.

The limestone appears to be of the same age as that at Bannock, but here it rests unconformably on granite. Here the granite contains no rich veins, and when they pass from the limestone into it they are much smaller and generally barren.

Argenta, a small mining town, is situated on the south bank of Rattlesnake creek. It is pleasantly located on a small tongue of the Beaver Head valley, surrounded by hills except where it opens out. Eastward it gives a splendid view of the Beaver Head valley, and of the Virginia mountains in the distance.

The mines are silver-bearing quartz veins, situated on the north side of the creek, and are not much worked at present. The only smelting works now in operation in the Territory are located at this place. On Horse prairie there are some good placers, but they are not available at present, owing to a scarcity of water. This will soon be remedied by a ditch from the creek, now in course of construction. On Rattlesnake creek, above Argenta, are very distinct marks of glacial action. The polish on the rocks is very fine, and the strike marked with great distinctness, showing a movement to the southeast.

Red Rock creek comes in from the south, and is probably the ultimate head of the Missouri river. From this creek to Dry creek, in the Snake River valley, there is an easy pass from the Atlantic to the Pacific slope.

SUMMIT DISTRICT.—The quartz veins in this district were the undoubted source of the gold in Alder gulch. Several of them were discovered and located soon after the location of the placer mines in the gulch below.

The first mill here, like the first at Bannock, was of Montana manufacture. A wagon supplied the iron; the choice lumber and the natural products of the district, with the labor of the builders, furnished all else. It was a financial success, but as the ore was carefully selected the yield was higher than has been obtained since. The mill was propelled by water; its capacity was three and one-half tons per week.

Since then many veins have been sold in the eastern States and a number of steam stamp mills erected, a few of which have been moderately successful. They only employ battery amalgamation, and pass the pulp over copper plates, which will not save as much gold as when iron pans or arrastras are used.

One mill has a great collection of costly mechanical curiosities, many novel and some obsolete. After a year's experience the operators still indulge in the anticipation of gratifying results. The method employed in these mills will not extract the gold from sulphuret ore. The mines contain a large amount of oxidized ore, which will eventually be exhausted, and the sulphuret ores will alone remain. Sulphurets constitute the main reliance for the future; and the working of any mill that cannot extract the gold from them will not be permanently profitable.

The mills in operation in this district crush about a ton to the stamp in 24 hours. The cost of working in two mills was $6 50 to $7 per ton, respectively, while in another it was estimated at $3 25 per ton; these were stamp mills. In another, the cost was $25 per ton. The cost of the stamp mills was from $20,000 to $30,000 each, according to their capacity, which varied from 15 to 24 tons per day. The cost of one mill was $120,000, with a capacity of about 12 tons per day.

Wood varies from $5 to $6 50 per cord; wages are from $6 to $9 per day.

About 20 mines have been located and opened to some extent in the Summit district. Among the most celebrated are the Kearsarge, Oro, Cash, and Lucas.

The Kearsarge vein is about two feet thick on an average, though in places it is six and a half feet. Strike, northeast and southwest; dip 45° to the northwest; opened to a depth of 120 feet; sulphuret ore at the bottom of the shaft pays in a mill $18 per ton.

Lucas vein, average thickness three feet; strike north and south; shaft 140 feet; ore sulphuret; yields $16 per ton.

Oro Cash vein, average thickness four feet; selected ore pays $80 per ton; opened 100 feet deep; ore sulphuret. The first lot of a few tons from this mine worked $216 to the ton.

There are many veins in this locality that will pay well when judiciously opened and worked.

HOT SPRINGS DISTRICT.—A large amount of money has been expended in opening mines and building mills in this district. The mills cost from $30,000 to $200,000, as estimated by men who have had good opportunities of obtaining correct information. The estimates may be too high, but it is certain the expenditures have been extravagant, compared with the capacity of the mills.

There are three mills in the district, two of which are running, the other nearly completed. The largest has 40 stamps, 20 of which are running. Its capacity is 20 tons per day. The capacity of the others is less.

The mill companies in many instances do not wish their results made public, as it might affect the price of their stock. In some cases, owing to the short time during which they have been running, no accurate estimates of the yield can be made. Within a year or two greater experience in working will result in something like a general average of profit to each mill.

In the Cape mill ore was worked from 18 different veins, in amounts averaging from 3 to 50 tons. The average yield from all the veins was $20 per ton. It is claimed that the Posey mine pays $100 per ton, and has been opened to a depth of 200 feet. The vein is very irregular.

The George Atkins is opened 50 feet deep; thickness of vein one to three feet; strike northeast and southwest; dip 45° to the northwest; works from $40 to $50 per ton. The country rock is granite.

Bevin's gulch, Granite creek and Williams's creek empty into Alder gulch from the southwest, and have some gold and silver-bearing quartz veins. They prospect well. Being now worked, their value will soon be known.

There are many gulches near Virginia, as the Norwegian, which is on the east side of the range and empties into the Madison, like Meadow creek and Flat Springs creek; the California, Brandon, Ram's Horn gulches and Mill creek; all contain veins that prospect well in gold at the surface, and many of them in silver and copper. When opened no doubt some of them will become valuable mining localities.

HELENA.—The Helena mines were discovered in September, 1864, at Dry gulch. Soon after, gold was found in Last Chance gulch, and as the latter gulch contained water and prospected richer, it became the centre of mining operations. After Alder gulch, this is the richest that has been worked in this Territory, and is yielding largely this season.

The depth of these diggings ranges generally from 10 to 20 feet. In some claims it is over 40 feet from the surface to the bed-rock. Work has been almost exclusively confined to the bed of the gulch. On the western side of the Prickly Pear valley, at and below the mouth of Dry creek, and on both sides of Last Chance gulch, there are hundreds of acres of shallow placers that will pay when water is introduced.

Owing to a scarcity of water, Dry gulch has not been very extensively worked. A supply has just been brought in by means of ditches from Ten-mile creek, and the prospect is now more encouraging. Last Chance gulch is formed by the junction of Grizzly and Oro Fino gulches, about half a mile above the town of Helena. Grizzly comes in from the south and Oro Fino from the north. Both have been worked extensively and profitably.

The country rock near Helena is limestone and metamorphic slate; further up in the mountains granite prevails. A large number of gold-bearing quartz veins are found in it, from which it is evident the gulches below received their gold.

Nelson's gulch, which heads in these granite mountains and runs into Ten-mile creek, has been nearly as rich as Oro Fino or Grizzly gulches. South from these heads are a number of gulches running into Prickly Pear, which have paid well. The greatest obstacle that the miners encounter is the want of fall in the beds of the gulches. They are too flat; but the same method of fluming with steam machinery for removing the tailings from the flume, recommended for Alder gulch, will be equally as efficacious here.

The mines around Helena are supplied with water by a number of ditches, the actual cost of none exceeding $100,000. Small ditches usually are profitable; large ones seldom pay the cost of construction.

THE PARK mining district is about five miles from Helena, at the head of Grizzly, Oro Fino, and Nelson's gulches. It is situated in a range of low rolling hills, at the foot of a high range of mountains. These hills are elevated to a considerable height above Helena, and are covered with pines and fir. Water is abundant and roads are of easy construction.

The mineral range is in granite, and about three-fourths of a mile wide and five or six miles long. The general strike of the veins is east-southeast and west-northwest, with a dip to the northward. The average thickness of the principal veins is three to four feet. On the northeast this district is bounded by a range of limestone; the greater number of veins is found in the granite near its junction with the limestone.

The greatest depth yet attained is 250 feet, following the dip of the vein. At that depth the ores are still oxidized. Sulphuret ores will soon be reached. In some of the veins sulphurets are found near the surface. This is not usual.

A number of mills have been erected in this district. Generally they have been successful in saving the gold. They are nearly all supplied with battery amalgamators, copper plates and arrastras.

THE WHITLATCH UNION VEIN has been more fully opened than any other in Montana. Its strike is east-southeast and west-northwest; dip 40° to the northward; thickness of vein from a seam to 15 feet; average 4 feet; opened to the depth of 250 feet, and in a number of points inclines have been sunk to depths from 100 to 200 feet. It has been traced for a long distance on the surface, and several different companies are at work on it.

The ore is worked with the greatest facility. Its average yield has been about $40 to the ton. One lot of 1,000 tons yielded $60,000, or $60 per ton. The gross yield, so far, has been $250,000, as near as is known by the working of the different mills.

On Ten-mile creek some veins have been located in limestone, which contain gold, silver, copper, lead, &c., but they have not been sufficiently developed to prove their depth or promise.

It is a general rule in Montana that where placer mines are found gold-bearing quartz veins will be found in the same vicinity.

On some of the bars of the Missouri river preparations are being made for mining.

At El Dorado bar a ditch is nearly completed to bring the water from New York gulch. When this is done the bar can be worked by hydraulics, and will probably pay. Recently it was supposed that diamonds had been found on the bar, but on examination the supposed diamonds proved to be sapphires. Some of them were fine, though small.

[illegible]st side of the Missouri are a number of gulches that have paid well. Clark, Oregon, and Cave have been profitably worked this season.

MONTANA BAR.—This bar is just below the mouth of Montana gulch, and near 300 yards above Diamond City. It is about one-fourth of a mile long and 300 yards wide. It is estimated that the best claims, of 200 feet in length, extending across this bar, paid as much as $180,000 to the claim. The earth was shallow and the bed-rock slate. Between the 9th of May and the 15th of August the whole bar was worked out. The gold was rather coarse and rough, showing that it had been washed but a short distance. The ground was slate, of the same character as the bed-rock.

The position of this bar is considered anomalous by the miners; nearly all say that it is a "slide," a term generally used in mining, like "electricity" in physics, to explain by words what is not conceivable in thought. No doubt the bar was formed by the action of water, in precisely the same manner as other bars are formed in small mountain streams. As it is lower than several other bars in this stream it must be of more recent formation. Along the sides of the gulch the ascent is very abrupt, the mountains on the east side being from 1,000 to 2,000 feet above the bed of the stream. On each side of the bar is a bed of ground from 200 to 250 feet above this bottom level, and a slide, to find its way to the centre of the gulch, must have passed over one or the other of these bars—an impossibility.

The gravel in the other bars is granite, with heavy boulders, evidently from the granite mountains on the east, while the gravel in Montana bar is slate. Very little quartz is found in this gravel, showing that the veins whence the gold came were soft and friable.

DIAMOND BAR.—Diamond bar contains the same gravel and the same quality of gold, and is really a continuation of Montana bar; above and below on this gulch nothing like it is found. The combined length of the two bars is not more than three-fourths of a mile.

At the head of Montana bar are a number of soft decomposed quartz veins, which probably supplied it with gold. If the veins were thoroughly explored, they would be very likely to prove rich in gold. Montana bar was entirely exhausted last year. Diamond bar is being very efficiently worked by hydraulics this year, and by the end of this season will probably be exhausted.

GOLD HILL, on the west side, will be supplied with water by a costly ditch and siphon, some time during the autumn. This will be more enduring than the bars in the bottom of the gulch. The bed and hill diggings to the southwest will be profitable mines for years. Some gold-bearing quartz veins have been found in the hills on the west side, but they have not been opened to prove their value, to any great extent.

NEW YORK GULCH has been worked for gold-bearing quartz. It has three mills, one of which is running. This district is somewhat out of repute at present; it is said the veins do not pay as well when followed down as at the surface. But this is probably the effects of overestimating the yield at the surface; and as greater depth is attained, finding the ore more refractory, it will not yield its gold to the simple working of the mills.

HIGHLAND DISTRICT, about 60 miles south from Helena, is remarkable as producing a very fine gold. It contains both placer and quartz mines, but is not as much worked as formerly. It is the most elevated mining district in Montana, and probably in the United States.

The Montana Post of August 31, 1867, says: "In Highland district the larger proportion of the lodes are gold-bearing, but specimens from some of these lately discovered and subjected to the action of fire show rich in silver. The following are the names of leads in Highland district:

No.	Names of leads.	Depth of shaft.	Width of crevice.
1	Ballarat	45	55
2	Forrest Queen	15	51
3	A. P. Nevins	43	6
4	Gold Excel	16	3
5	Only Chance	50	3
6	Park	20	30
7	Talcoe	17	4
8	Bijou	13	7
9	East Wheel Rose	24	15
10	Oro Pietra	Crevice found.	6
11	Wilbur	44	7
12	Voleny	12	6
13	Gallus Widow	10	4
14	Belfast	16	47
15	South America	18	6
16	Reward	Crevice found.	33
17	Roanoke	10	6
18	Corydon	Crevice found.	6
19	Hyland	do	7
20	Coleman	do	8
21	Camp	23	5
22	I. N. Meyers	10	6
23	Bendigo	10	7
24	Red Mountain	11	6
25	Waterbury	Crevice found.	3
26	Iron Rod	do	8
27	Highland Summit	10	5
28	Golconda	11	5
29	General Warren	Crevice found.	12

During the last summer the mining current has set to the north, along the Big Blackfoot. A number of gulches have been extensively worked, and have produced largely, as Washington, Jefferson, Lincoln, California, and McClellan gulches.

In the heads of these gulches gold-bearing quartz has been found. The placers only have been worked, and they have paid well. The hostility of the Indians this year has prevented explorations further north. It is probable that when explored, gold will be found on both slopes of the Rocky mountains north to the British possessions.

The mines on the Little Blackfoot have paid well this season, particularly at Carpentier's bar, and on Ophir gulch, near Blackfoot City. Many other gulches in this vicinity have also been productive, and the yield of Deer Lodge county will be greater this year than ever before.

At Silver bar and Butte City the mines have done well. Placers only have been worked; but in every gulch where good placer mines are found, gold-bearing quartz veins are found also, many of which contain silver, copper, antimony, arsenic, and manganese, and are rich but very refractory.

At Butte City some copper mines have been discovered, and a furnace erected for smelting. Owing to a defect in the blast it was not successful. The ore, which is quite abundant, is composed of oxides and carbonates in a concentrated form. It contains gold and silver, and with a well regulated furnace there would be no difficulty in smelting it.

These veins are found crossing a belt about one mile wide and four or five long, and show evidence of being deep and permanent.

Along the eastern side of Deer Lodge valley, north from Butte City, are a number of gulches which have been prospected lately, and promise to pay well.

Comstock.—At Butte City resides Henry Comstock, famous as the discoverer of the Comstock lode,[*] of Nevada, the discovery of which inaugurated the era of silver mining in the United States. Although a man of the strictest temperance, using no stimulant stronger than tea or coffee, and not even tobacco, years and the hardships and excitement incident to a frontier life are telling painfully on his faculties. In a conversation with him he referred to his past career—especially his connection with the lode that bears his name. His intellect appears to wander, although his hand still retains its cunning. He is a skilful prospector, but his fading recollections carry cloudy images to his darkened understanding. He imagines he owns the whole Comstock lode, and the cities of Gold Hill and Virginia; but as he has no immediate use for them, he allows others to live in his houses; the people are poor, and it would be hard to turn them out, especially in the winter. This feeling of benevolence in the old man is genuine, and one that he habitually practices. He has a small claim that pays little more than wages. If a poor miner comes along without means, he gives him an opportunity to work in the claim until the suffering stranger has the means to go on his journey.

Recently an emigrant came along who was sick and could work but little. Comstock and he worked together in the claim; the old man doing the most laborious part until the emigrant concluded to leave. Comstock then divided what was taken out, and seeing it was too small for a man to travel on, said: "Now, we will divide my half again; you will need it."

He says that at times he thinks if the government of the United States knew how he is situated, it would not let him suffer.

Flint Creek.—On Flint creek several silver-bearing veins have been found recently, which show large amounts of rich ore at the surface. They have not been opened so as to prove their depth or continuity. The country rock is limestone.

Hot Springs.—At the head of Hot Springs creek, a mine called the Atlantic Cable has recently been found containing an oxide of iron, rich in gold. It is said to be a slide. The ore is wonderfully rich and easily worked.

The Jefferson Basin.—This basin is drained by the Jefferson Fork of the Missouri river and its tributaries, to wit: the Big Hole, Beaver Head, and the Stinking Water. It is about 150 miles long, and 100 wide. In this basin the first extensive mining operations were conducted, and the first town of any importance was built. It still contains a number of important mining localities.

The Big Hole is so called from a small round valley near its head, surrounded by a range of high mountains. Here the snow falls to a great depth in winter. As it melts in the spring and summer, it swells the Big Hole to a large and rapid stream, from 50 to 75 yards wide in the lowest stages, and much wider in the highest. The bars and bottoms along this stream are subject to overflow, and are generally rocky and barren. Big Hole basin affords good pasturage in the summer, but it is too cold for agricultural purposes.

In 1805 Lewis and Clark attempted to ascend this river, but found the current so rapid, and the number of islands and other obstructions so great, that they turned back and ascended the Beaver Head river.

Gold has been found in small quantities in some of the tributaries of this river, but not in sufficient abundance to pay for washing. Coal is said to have been found in the basin, but the deposits have not been explored sufficiently to determine their value.

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[*] The first discovery of silver was made in Gold cañon. near Silver City, by E. A. and H. B. Grosch. in 1857. The first quartz claim was located in the Ingrim district, in February, 1858, by James Finney. In June, 1859, Peter O'Reilly and Patrick McLaughlin made the first discovery of rich silver deposits on what is now the ground of the Ophir Company. Comstock is not justly entitled to the credit generally awarded him for this discovery. (See preliminary report on Mineral Resources of the West, printed by Congress, January 8, 1867, pp. 27 and 85.)

Game, such as buffalo, moose, elk, deer, beaver, and mountain sheep, are abundant.

The Beaver Head is longer and drains a larger area than the Big Hole, and may fairly claim to be the head of the Missouri.

BANNOCK CITY.—Bannock City is built on the north side of Grasshopper creek, on a small flat or bar of just sufficient size to hold the town, and very near the entrance of Grasshopper cañon. It is an irregular wooden town with one principal street running parallel to the creek, containing but a few hundred inhabitants at present. In 1862–'63 it was a good mining camp, and business was brisk. Its main dependence for the future is the gold-bearing quartz lodes in the cañon below.

Bannock was the first mining town built in Montana, and the first district in which gold mines were worked extensively and profitably.

The winter of 1862–'63 was remarkably mild, so that supplies could be hauled from Salt lake during the coldest months. Had that season been as severe as the winters have since been, the whole population might have perished from starvation. Coal is reported to have been found in the valley of Grasshopper creek, about four miles above Bannock, but its value has not been ascertained.

STINKING WATER.—The next stream which contributes to form the Jefferson is the Stinking Water. Its Indian name is Passamarine, one of the most musical in the Indian language. It is not improved by its rendition into English. On this stream and its branches many rich mines are found.

In the ranges of mountains between the Stinking Water and the Madison fork of the Missouri, sent down into the former, are a large number of creeks and gulches, nearly all of which have proved to be rich in gold, and some of them in silver. The principal are Wixansen, Ram's Horn, Bevins, Harris, California, and Alder gulches, and Mill creek.

ALDER GULCH.—Alder gulch rises in a spur of the Rocky mountains, and runs north. It is from 15 to 17 miles in length, and empties into the Stinking Water, a branch of the Jefferson fork of the Missouri river. It has many side gulches or tributaries, but none of them except Spring and Bowers gulches, which are near its head, have any gold, or at least not sufficient to pay. The hills on each side are rounded off and covered with soil, presenting the soft outline of an agricultural country. The denuding effects of time have doubtless been of long continuance.

A careful examination of the gulch will convince any one that the gold in it came from near the head, at its junction with Bald mountain. The gold at that point is coarse and rough, with portions of quartz adhering to it; further down the stream it becomes finer and brighter, showing unmistakable evidence of having been worn by the action of water. Near the mouth it is excessively fine, and cannot be collected in a satisfactory manner except by the use of quicksilver.

The gravel is very coarse and heavy high up the gulch, containing many boulders of a large size; further down it becomes worn away to small particles, and at the mouth only sand and very fine gravel are found. The country rock at or near the head is gneiss, and the same rock holds for a considerable distance; below it is replaced by micaceous slate. Near the head the rocks rise on each side in a very precipitous manner, forcing the gulch into a narrow cut or fissure, but below, at the distance of three or four miles, it widens out. The paying portions correspond in width to the bed of the stream, and are richest where the bed is narrowest.

This gulch is a vast natural quartz mill and mine. Frost and atmospheric action loosen the quartz containing the gold, and throw it down, when the attrition caused by the current of water pulverizes and washes away the gangue, leaving the gold behind. This action, though very slow, extending back through countless ages, produces stupendous results.

The number of quartz veins found at the head of Alder gulch, known to contain gold in sufficient amounts to add materially to its products, is not more than 20, of which the average width is about two feet, and the average assay value about $10 per ton, estimating all the vein stuff between the walls.

Alder gulch has produced more gold than all the others, and probably more within the last three years than ever was taken in the same time from any gulch of the same extent. It is the opinion of those best qualified to judge that within three years from the commencement of mining operations on this gulch $30,000,000 were taken from it. This estimate may be exaggerated, but the amount taken out was certainly beyond precedent in Montana.

The mines were discovered in the spring of 1863, and in 18 months a population of 10,000 had gathered together on the banks of the stream, building up four considerable cities, to wit: Nevada, Central, Virginia, and Summit City. Virginia was built first, and, occupying a central position, always maintained its supremacy. It is pleasantly located on the east bank of Alder gulch, and contains a number of fine stone buildings, consisting of banks, stores, markets, dwellings, &c. It supports two newspapers, and is one of the chief mining and commercial centres in Montana. Helena is its only rival. Although the first excitement incident to the discovery of a new and rich mining district has passed away, and the mines most easily worked have already been worked over once, still the annual production is large. By proper working, as will be explained hereafter, the future production may be made equal to the past.

It is the opinion of the best judges, as already stated, that $30,000,000 have been taken out of this gulch by the miners.* This cannot be considered more than one-fourth of the amount that has come from the veins at the head of the gulch. Probably one-tenth would be nearer the amount, especially when we consider the extremely divisible nature of that metal and the facility with which minute particles are transported by water, a large portion of them being so small that it is impossible to collect them by any gold-saving process yet devised. Rating the amount already extracted at one-fourth, this would give $120,000,000 as the actual mineral value of the gulch. At $10 per ton this would require 12,000,000 tons of quartz to be reduced, provided all the gold in the rock is extracted. At 13 feet to the ton a result of 156,000,000 cubic feet of quartz must be reduced to produce that amount of gold; equal to the product of 20 veins two feet thick, each a mile long and nearly 1,000 feet deep.*

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* Such a product from one gulch is beyond all precedent, and must appear a great exaggeration. But if well-authenticated facts are examined the amount appears more reasonable. For a considerable time the population was 10,000 or upwards; probably 3,500 workmen in the mines. Ten dollars per day for 220 days in the year would give $26,950,000 for three years and a half. Wages were from $10 to $14 per day. Nearly all of the mines were worked by hired labor and the mines almost universally paid a profit above wages. The whole number of claims was between 1,000 and 1,100; at 1,000 each claim must give a gross yield of $30,000.

Montana is the most difficult mining region in the United States in which to estimate the yield of the mines. Occupation has a great effect in the formation of opinions on this subject. Bankers and expressmen always underestimate; merchants and successful miners generally overestimate; unsuccessful miners underestimate, while ranchmen and farmers have no opinions based upon any reliable data on the subject. After the gold is taken from the mines it passes through a number of different channels, some of which enable us to estimate the amount produced with tolerable accuracy, whilst in other cases no accurate conclusion can be formed. A portion is sent by express to the mint for coinage. Remittances by merchants are generally known to comprise the amount that miners expend for current expenses; also, what they send to their families or friends in other places. A small quantity is used for a circulating medium; this also comes from the miners as current expenses. A considerable amount is buried in the earth by the miners, but no accurate estimate can be formed on this point. Of the amounts carried out of the Territory a portion is taken by the miners themselves; of this no account appears. If a miner goes to California he takes his dust with him, and it is carried to the credit of California or Oregon or Nevada, as the case may be. Some is carried to foreign countries, as the British possessions, which join Montana on the north; lastly, a portion is kept in the form of specimens or for jewellers' uses. Thus we see it is difficult to arrive at more than an approximation.

An account of the amount of the goods brought to the Territory furnishes a criterion for some statisticians, who, assuming that the goods were all paid for, add the amount to what gold is supposed to be in the country and what was sent out for other purposes, and make the sum total the gross production of the Territory. This is a very loose way of getting at results. Others take the cost of board per week, say $4 to $8 when wages are from $5 to $9 per day, and state it thus: as 6 to 42, so is the amount expended for provisions to the gross yield of the mines. Manifestly incorrect, as many are non-producers. Probably the best criterion is the price of labor. A mine owner will not long employ men unless he derives a profit, and miners will not work for the same amount that they are sure of making by themselves, for they think they may "strike it rich" on their own account. Alder gulch is an exception, for here is a limited number of claims, and those who have no claim cannot make wages by prospecting.

The general appearance of the country warrants the belief that the denudation is fully equal to 2,000 feet. Bald mountain, which stands at the head of the gulch, rises to the height of between 2,000 and 3,000 feet above the quartz veins at the head of mining operations. A great length of time must have elapsed since this denuding operation commenced, and it is still in action and will continue until either man forestalls nature in extracting the gold from the veins, or some great upheaval changes the face of the country and causes the formation of a new set of watercourses.

The country rock contains a large amount of mica. After a gentle shower the whole face of the earth is colored a fine bronze.

The first mining district found on the gulch was Fairweather, called after one of the discoverers. Above this were Highland, Pine Grove, and Summit, and below, Nevada and Junction, their locations extending from Fairweather district in the order in which they are named. Each had a code of laws almost identical with that of Fairweather. These laws have been subject to trifling changes, and generally have been very satisfactory in their operations.

In the lower districts claims only come to the centre of the gulch, thus giving double the number that were held above; the same on the banks. Not far from 1,000 claims are located in this manner, and it is remarkable that nearly every claim paid for working when wages were from $10 to $14 per day in gold. From many of the best claims $150,000, and from some as much as $200,000, have been taken out.

The usual method of working was to sink a shaft 14 or 15 feet to the bed rock and extract the rich gravel, which was from one to three feet thick, by drifting. In this way a considerable amount of ground was left as pillars to support the ground above. The bed rock cannot be worked with the care necessary to extract all the gold. When gold is very abundant the miners become careless and do not work closely. This gulch was worked to a great extent by hired men, who are not as careful as the owners of the mine. In some of the deepest claims water retarded the working or prevented it entirely. Owing to these causes it is probable only about half the gold has been taken out that can be obtained by careful and thorough working. The object of each miner was to get as much gold as possible in the shortest time and depart for his home, expending only sufficient to defray current expenses.

The water in the gulch nearly sufficed the wants of the early miners. Up to this time only two small and inexpensive ditches have been constructed. It is proposed to bring water from the Jefferson or the Stinking Water rivers. From the Jefferson a large amount could be brought in at the head of the gulch, but the cost would be great. From the Stinking Water the cost would be less, but the water could not reach the head of the gulch by two or three miles, and the supply would be insufficient.

Near the upper part of the gulch small flumes are in course of construction.

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* This, however, is a very unreliable mode of calculation.—J. R. B

They are disconnected and too short to be efficient. To work in the most economical and thorough manner requires a large flume from the mouth of the gulch up to the head, with a large amount of water.

The greatest obstacle to placer mining in Montana is the want of fall or descent, and this is particularly the case in Alder gulch. To overcome this difficulty and keep the works in running order it will be necessary to have the flume double at certain points, with a reservoir in each, so that when one reservoir is filled with sand and gravel, the water can be turned into the other flume while the first reservoir is emptied. This can be done by a steam paddy or other machinery. By having places for the sand to settle and be removed at two or three points along the flume, it can be kept in running order.

By such a flume system and the use of hydraulics the gulch can be thoroughly worked, and its future production made at least equal to its past. This method of mining requires capital. The miners generally are employed by an individual or company and the profits divided amongst few. The last working usually occupies about twice the length of time occupied by the first.

Summit City.—Summit City is substantially built of logs, but in building this town the streets appear to have been forgotten at first and put in afterwards. In case of fire the whole town would burn with as much facility as a single house. It seems strange, after so many mining towns have been utterly destroyed by fire, that in laying out a new one, where the ground costs nothing, the streets should not be left sufficiently wide to form a barrier to the progress of fire, as well as a means of communication. With a sufficient width, a fire could be confined to one square.

The rich and extensive quartz veins in this vicinity will probably render Summit City permanently prosperous.

Nevada.—After Virginia, Nevada was the largest town on Alder gulch. At present it shows signs of decay. In the winter the people of the inhabited parts of the town make use of the uninhabited houses for firewood. If a bed-rock flume is put in the gulch, Nevada will probably regain in some degree its former life and activity.

Junction City and Central City were also at one time lively little towns. Now they are more remarkable for quietness than for the commotion of business.

Most of the other gulches in this vicinity have small collections of houses, hardly sufficient to justify the name of towns.

The range of mountains called Virginia is not as high as the mountains around the head of Big Hole; still they are sufficiently high to retain snow the greater part of the year. This range abounds in springs and streams of running water, and forests of pine and fir in the ravines and cañons.

Valley of the Stinking Water.—The valley of the Stinking Water is 15 or 20 miles long and 5 or 6 broad, with some good farming and grazing land, but generally it is not very fertile. At the confluence of the Big Hole and the Beaver Head is a large valley very similar to the valley of the Stinking Water. By a proper system of irrigation both of these valleys could be rendered available for agricultural purposes. Want of timber is one of the most serious inconveniences.

Among the old mountaineers this fork of the Missouri was known as the Beaver Head, and took its name from a point of rocks on its north bank, about 15 miles above the mouth of the Big Hole, called by the Indians Beaver's Head, which it closely resembles when viewed from a point near the mouth of the Stinking Water.

Gallatin Valley.—The section of country drained by the Madison, Gallatin, and the Missouri down to its junction with the Dearborn river, is about 175 miles long and 80 miles wide. In this district of country lies the valley of Three Forks and Gallatin, about 40 miles long and 12 wide, which may be considered the garden of Montana. The season is from four to six weeks earlier than in the valley of the Big Hole, and the climate is as good as that of Utah, while in fertility the soil is unsurpassed. Here farming is on a large scale, and in the course of a year or two the valley will supply the Territory with wheat and barley, as it now does with potatoes and vegetables.

OTHER VALLEYS AND PLACERS.—North and south, Boulder and Wallace creeks empty into the Missouri from the west, and have some good but not very rich placer mines; also some quartz veins, containing gold, silver, lead, and copper; but they are not attracting much attention at present.

Further down comes in the Prickly Pear. On this stream and its branches are some excellent mines. The towns of Montana, Jefferson and Beaver cities are situated on this stream. Placer and quartz mines exist here, but are doing but little at present.

The most productive gulch in this part of Montana is Last Chance, which is formed by the junction of Oro Fino, Grizzly, and Dry gulches, and empties into the Prickly Pear not far above its mouth. These gulches have been very rich; also Nelson's gulch, which empties into Ten-mile creek. On this creek are numerous quartz veins, containing gold, silver, copper, &c., not now much worked.

HELENA.—Helena, the largest town in the Territory, is situated on both sides of Last Chance gulch, principally on the south side, and extends over an elevated bar to Dry gulch, a distance of three-quarters of a mile. It is well and regularly laid out for a mining town, containing a number of fire-proof stone buildings. Many of the wooden buildings have fire-proof safes attached to them, or an outside cellar with fire-proof walls and door, and are covered with heavy dirt roofs. Their construction is not costly, and in combustible mining towns they do good service in preserving valuable goods from fire.

Helena contains an active population of miners, merchants, physicians, lawyers, bankers, and that miscellaneous crowd always found in the best class of mining towns. Residents claim that its population numbers from 7,000 to 8,000; this is probably an exaggeration. As a commercial centre it has stage lines connecting it with Virginia, Diamond City, New York Bar, Fort Benton, and Blackfoot City. Nearly all supplies for the south pass through it on their way from Fort Benton.

The most productive gold-bearing quartz veins in Montana, as well as silver and copper mines, (the latter unworked,) are in this vicinity. The placers are extensive, and well supplied with water by a system of large and costly ditches. On the heads of Grizzly and Oro Fino gulches the mountains are covered with pines and fir, and along the Prickly Pear cottonwood is abundant.

The valley of the Prickly Pear and Ten-mile creek contains a considerable amount of good farming land and a number of farms under cultivation, and the surrounding hills afford good pasturage. This valley is nearly circular in form and 15 miles in diameter.

Helena is located on the western side, close under the foot of the mountains. A more picturesque or beautiful situation for a town can scarcely be imagined. A broad vista stretches away to the east, beyond the Missouri river.

BAR MINING.—From the mouth of the Stinking Water down to the Great Falls all the bars on the Missouri river contain gold. These bars will probably be among the most lasting placers in the Territory. Up to the present time they have remained unworked, except El Dorado bar, upon which operations have already been commenced, and it is reported with favorable results. Along the Missouri there is some good farming and grazing land, and generally the hills in the vicinity contain timber.

Confederate, New York, and a number of other gold-producing gulches come in from the east, just above the mouth of Prickly Pear.

CONFEDERATE GULCH.—Of these, Confederate is the richest; after Alder and

Last Chance it is probably the richest in Montana. It has produced largely since 1865, though its product has not been so great this year as formerly. Diamond City sprung up on this gulch, but has been nearly abandoned by the washings from the hydraulics in the rear of the town.

The mountains around the head of Confederate gulch are high, and contain pine and fir timber; also numerous streams. Some very expensive ditches are in course of construction for supplying the mines with water.

Estimated yield of Montana.

1862	$500,000
1863	8,000,000
1864	13,000,000
1865	14,500,000
1866	16,500,000
1867	12,000,000
	64,500,000

IDAHO.

SECTION I.

AREA AND POPULATION—MOUNTAINS, RIVERS, LAKES, WATERFALLS, AND BOILING SPRINGS—VEGETATION—GEOLOGICAL FEATURES—TOWNS AND MINING CAMPS.

Area and Population.—In form, this Territory is almost a right-angled triangle. Its base, about 350 miles long on the south, rests on Nevada and Utah, with a perpendicular of about 420 miles, separating it from Oregon and Washington Territory on the west. Its northern point touches the British possessions, and its hypothenuse on the northeast divides it from the Territories of Montana and Dakota. Its area is about 90,000 square miles,* but inasmuch as its northeastern boundary, on the crests of the Bitter Root and Rocky mountains, has never been meandered, this estimate is only an approximation. Its population is about 20,000 at this time. As estimated by the territorial assessor it was somewhat larger in 1866, viz:

Table showing the principal cities and towns of Idaho Territory, the county in which each is located, the estimated population September, 1866, *and the distance of each from Boise City; the territorial capital.*

Counties.	Name of town.	Estimated population, July, 1866.	Miles from Boise City.
Ada	Boise City	2,050	....
Alturas	Rocky Bar	675	100 N. E.
Boise	Centerville	1,100	45 N.
Do	Idaho City and Buena Vista Bar.	5,860	36 N. E.
Do	Pioneer City	1,700	55 N. E.
Do	Placerville	1,000	40 N.
Idaho	Florence	600	250 N.
Do	Miller's Camp	150	230 N.
Do	Slate Creek	75	260 N.
Do	Warren's Diggings.	1,100	230 N.
Nez Perce	Clearwater Station	290	330 N.
Nez Percé	Elk City	450	350 N.
Do	Lewiston	630	350 N.
Oneida	Bear Lake	300	450 E.
Do	Malade City	425	348 E.
Do	Soda Springs	75	450 E.
Owyhee	Boonville	400	72 S.
Do	Ruby City	1,000	70 S.
Do	Silver City	3,175	70 S.
Shoshone	Oro Fino	350	450 N.
Do	Pierce City	300	450 N.
Total	....	21,725	

Mountains.—The principal mountains are the Rocky, Bitter Root, and Bear mountains on the east. The upheaval of these ranges has tilted the whole Territory to the west at a greater angle than that of any other State or Territory of the Pacific slope. In the south, the Owyhee is the principal range, though properly it is an isolated spur rather than a range. This region of country contains one of the principal mining districts in the Territory. The Bear and Rocky mountains are different branches of the same range, and have the same general character. The name "Rocky mountains" is a misnomer. Instead of being rough and rocky, they appear to be old, with their highest peaks abraded, worn down, covered with soil, supporting timber and grass, full of low passes, suitable for wagon or railroads, and embracing many fine agricultural valleys. The Bitter Root is a broad, lofty range, continuous and unbroken, with a few elevated passes, which are closed in winter. It abounds in rugged spurs, deep gorges, and tremendous cañons, where the Salmon river runs in a continuous torrent.

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* The Commissioner of the General Land Office estimates the area at 90,932; number of acres, 369,529,600.

The Boise range is a spur or lateral offshoot of the Bitter Root. They are well covered with pine and fir, with good pasturage in the foot-hills and farming lands in the small valleys. The height of this range is 8,000 or 10,000 feet, with some peaks that attain an altitude of near 12,000 feet.

Rivers.—The Snake river and its branches drain the whole Territory, except a portion of about 120 miles long and 45 wide in the extreme northern part, which is drained by Clark's fork of the Columbia and its branches, and an irregularly-shaped portion in the southeastern corner, which is drained by Green and Bear rivers. Bear river falls into Salt lake, and Green river empties into the Colorado. This portion of the Territory has some farming and a large amount of good grazing lands, and is very scantily supplied with wood. No mines have been discovered in it. The Mormon settlements on Bear river extend for a short distance into Idaho along the stage route, but otherwise this portion of the Territory is uninhabited. The principal branches of the Snake river in Idaho are the Clearwater, Salmon, Payette, Boise, and many small rivers and creeks, which uniting form a large river, with many falls and rapids and a current of great swiftness, which, when high, carries away bridges and boats and renders crossing it dangerous. It is navigable to Lewiston. A steamer has been recently built near Fort Boise, but is not running at present, the swiftness of the current rendering navigation always difficult and sometimes dangerous. Among the falls on this river, one of the most noted is the American, about 25 miles below Fort Hall, which has a perpendicular descent of 60 or 70 feet, but is not remarkable for the grandeur of the surrounding scenery.

Shoshone Falls.—The Shoshone falls are situated about seven miles from Desert station, on the stage road from Salt Lake City to Boise City. The river for many miles, both above and below, passes through a volcanic valley. It has cut a perpendicular cañon through the layers of lava to the depth of about 1,000 feet. The cañon is generally about half a mile wide. At the point where the falls are located it is nearly a mile wide. Viewed from below it appears circular, like a vast amphitheatre, with the falls in the centre. The different layers of lava resemble seats in tiers ranged one above another to a height of 700 feet above the head of the falls. In the narrowest part the water is 200 or 300 yards wide. About 400 yards above the main falls are five islands, at nearly equal intervals across the river, dividing the stream into six parts. As the water passes between the islands it is precipitated 25 or 30 feet. The falls differ essentially from each other in form, affording great variety. Below the islands the water unites and passes in an unbroken sheet over the great fall; the descent is about 200 feet. The semicircle at the head of the falls is apparently perfect, and the leap as clear as that of Niagara. Enormous clouds of mist and spray arise, variegated with rainbows. At the foot are rushing showers of spray, from under which the water, beaten into foam, dashes furiously away. Occasionally can be seen through the flying mists the immense sheet of water standing out in bold relief from the rocks, showing that with proper appliances it is practicable to go behind, as at Niagara. A few hundred yards further down the water swings slowly around in a huge whirlpool and then disappears in the black cañon below. The delicate prismatic colors of the rainbow and the graceful evanescent forms of the mist contrast strangely with the iron-black surface, hard outlines, and awful forms of the overhanging basalt. The sound of the rushing waters resembles that of an orchestra, the small falls giving the high notes and the great falls the bass, producing a combination not possible to obtain from a single undivided current. At Rock Creek station, 20 miles distant, it can be heard distinctly—not continuously, but at intervals, like the surf. When the notes strike in unison they can be heard at a greater distance. In the winter this mist rises like the smoke from a volcano. A few diminutive pines grow among the rocky declivities of the cañon. The plain produces only sage brush. The hostility of the

Indians renders a visit to this interesting region somewhat hazardous, unless with a party of six or eight men, well armed and on the alert.

Salmon Falls.—The Salmon falls, about 45 miles below the Shoshone, are some 20 feet in height, and are remarkable as forming an impassable barrier to the progress of the salmon. Here is a famous Indian fishery.

Valley of the Snake.—The valley of the Snake is a huge crescent-shaped basin, about 500 miles long and 250 at its greatest breadth. The whole interior is a bed of volcanic rocks, in which the rivers have cut deep cañons. The surrounding foot-hills are generally covered with bunch grass, affording excellent pasturage. Along the streams are many valleys, containing tracts of land well adapted to agriculture. Frequently these valleys extend through the basin to the Snake river, as the Boise, which is well cultivated, and contains many farms in a state of improvement that would do credit to older countries. But the greater portion of the basin is a desert waste of sand, producing nothing but sage brush and a very limited amount of bunch grass, even in the most favored localities. The Indian name for the river is "Pohogwa," or "Sage Brush river," the most appropriate that could be imagined.

Sage Brush.—This shrub in general appearance resembles the cultivated sage, having the same form and color, flower, leaf, and branch; its aroma being similar but stronger and not so agreeable. Its average height is about three feet; sometimes it attains the height of five feet, with a diameter of four or five inches. The sage is strictly the shrub of the desert. From the eastern foot-hills of the Rocky mountains to the Pacific ocean, and from Mexico to the British possessions, it occupies nearly all lands too poor and dry to support any other vegetation. It burns even when green, with a quick bright flame, and in many extensive districts is the sole fuel of emigrants, miners and prospectors. In the Slate Range district, in the southern part of California, it was used successfully as fuel in generating steam for a quartz-mill. The cost of gathering and using it is about the same as that of wood in a moderately wooded district. Where Indian labor is available it is much cheaper. A smaller variety called the white sage is valuable for grazing in the winter. Cattle thrive on it, but it imparts a peculiar though not a disagreeable flavor to beef.

Boise Basin.—In some parts of the Boise basin the sand is loose, and the wind drifting it over the plains obliterates all traces of vegetation. Whirlwinds often raise it to great height, and when one of these dust storms passes a train of men and animals, the air is darkened, and breathing is rendered difficult until the storm is over. In the northeastern part of the basin, on the south side of Clark's Fork, are three lone mountains called the Three Tetons; they rise ragged and sharp in their outlines, and form a notable landmark for travellers. North of Fort Hall are three similar peaks called the Three Buttes, visible for a great distance. The highest, called Cedar Butte, is near where Lewis's Fork empties into the Snake. It is scantily covered with scrub cedars, and, like the others, is undoubtedly of vocanic origin. When the whole country is densely populated the Snake river will be turned out of its bed, and used to irrigate this basin. In that way it can be rendered productive. If this river and its tributaries should thus be directed, navigation would sustain but little loss, while agriculture would be greatly benefited. All the streams emptying into the Snake some distance below the Shoshone falls sink before they reach the river, and passing under the strata of lava, come out on the sides of the Snake cañon. Several of them shoot out at such a height as to form beautiful cascades; some at perpendicular leaps, others in a succession of small falls; some combine falls and rapids, and assume the most beautiful forms of falling water imaginable. The white spray and foam strikingly contrast with the black precipitous walls down which the rushing torrent plunges into the river below. In one case a river ran over the surface until it had worn into the rock a cañon about a half mile long. A beautiful basin or small lake still remains where the water formerly passed over. In process of time it formed an underground channel, and now comes out at the foot of the rock where the falls once existed. It is perfectly clear, and although the depth is great, the trout with which it is crowded can be distinctly seen at the bottom. Along the stream on each side of the cañon is a narrow belt of fine grass and willows, entirely hidden from view, until the spectator stands on its banks. The contrast between the beautiful verdure here and the awful desolation of the surrounding plain is very striking. All over the vast volcanic wastes of the plain are upheaved masses of lava, with clefts or fissures in them, caused by the cooling of the liquid rock. These elevations are generally of an oval shape, with a cleft in the centre extending longitudinally from the summit to the base. Others have two lines of fractures nearly at right angles. They sometimes form ridges exceedingly tortuous in their course, occasionally twisted into a circle. Their usual height is from 6 to 12 feet. These masses of rock appear almost to defy the elements. In many places the corrugations formed on the surface, when the lava was cooling, appear as distinctly as if they were formed yesterday. Along the edges of the deposit the lava in some places overlies granite, in others slate and limestone. The action of the elements has worn these strata away, leaving the lava apparently undecomposed, and elevated above the rocks that once held it in bounds. A great difference is found in the power of different rocks to resit the action of the elements. Thus, slate when soft and splinty is less capable of resistance than limestone, and this rock is less enduring than the coarsest forms of granite. The hard compact granite resists much longer than the softer varieties; but all much less than the basaltic lava in this valley. The same is observed in almost all cañons where there has been a lava flow, as in Port Neoaf and in Moor's creek. These facts afford material for a time ratio. If the resisting power of basalt is represented by 100, and hard granite 90, soft granite 75, limestone 50, soft slate 40, gravel 5, and ordinary soil 1, or if we adopt any other ratio of a similar kind found to be in accordance with observation, we have a basis by which a calculation can be made with approximate accuracy.

Around the base of the Boise mountains there are indications of upheaval to a certain extent since the bed of lava was formed. The strata are all tilted from the mountains, both on the eastern and western sides, but it is most noticeable on the eastern side. At the base of the Owyhee mountains the proofs of upheaval are clear. Since the lava was formed, many beds of regular columnar basalt are displaced, and the columns stand at different angles, showing unmistakably the effects of more recent convulsion. On Clover creek, a small tributary of Snake river, about 40 miles below the mouth of the Malade, are three volcanic bridges within a third of a mile of each other. The stage road passes over them in the wet seasons. One of these natural bridges is over a dry ravine, which runs into the creek. There is an island at the point where the stream is bridged. The first bridge is from the shore to the island, the next from the island to the other side, and the third over the dry ravine. Their height varies from three to seven feet; the arches span from 10 to 50 feet, with lengths from 100 to 200 feet. It is probable the craters or source whence this vast bed of lava flowed must be near the upper end of the valley, as it has a regular descent to the westward. But this is not certain, for the inclination may be the effect of the upheaval of the Rocky mountains, which may still be going on. It is highly probable these mountains had nearly their present altitude before this vast eruption of lava took place; after that their upward movement may have continued, which would account for the singularity of its declination to the west. About 10 miles west from the bridges over the Malade on the stage route from Salt lake to Boise City, there is a circular depression in the plain about three-fourths of a mile in diameter. In the winter this is filled with water, forming a shallow lake. The lava around this depression is remarkably well preserved, and all the wrinkles or corrugations caused by the moving and cooling of the surface are as distinct as though they were very recently formed. By observing these foldings the direction in which the lava flowed can be determined. It is apparent in this case that the flow was in every direction from the depression, proving that this was one of the craters which once poured its fiery flood over the plain. When the supply from below was exhausted the mouth of the crater sank back, leaving the depression now nearly filled with alluvial deposits. A close examination of the plain would undoubtedly lead to the discovery of many similar openings, and by a careful observation of the relative elevations on the eastern and western sides of these craters, it could be demonstrated whether the level of the country has been affected by upheavals since the lava bed was formed. At the crater examined, the lava on the eastern side appeared to have run up hill, while on the west the declination seemed unchanged. The Snake river has cut a vast cañon through this plain, varying in depth from 100 to 1,000 feet. The different strata of the rock can be distinctly observed in this cañon. The length of time required by the river to wear away such an enormous fissure must have been great, although the descent of the water is rapid. The Shoshone Falls probably cut out the cañon below it to the Salmon Falls, a distance of over 40 miles. No observations have been made to determine the rate at which the rock is worn away; but from its indestructible nature it must be slow. The Boise basin divides the mining portions of the Territory into two parts; one south and one north. The southern or Owyhee mines are in the Owyhee mountains, and do not cover near the extent of the northern portion, which embraces the Boise, Lemhi, Salmon river, and Oro Fino mines.

TOWNS.—Boise City is situated on the east side of the Boise river, at the head of the fertile valley of the same name. It has a beautiful location, is well laid out, and contains many fine buildings. Nearly all the passengers and supplies for Boise Basin have to pass through it; hence it is a great staging centre. Situated between the Owyhee and Boise mines, it will long be the commercial centre of the southern part of the Territory. The climate is milder than in the mines, and resembles that of Utah. Boise Basin is about 30 miles northeast from Boise City. Its length is from 15 to 18 miles, and breadth from 6 to 8. It contains a number of towns and many mining districts, and is the most populous part of the Territory. The present population is estimated to be about 10,000. Idaho City, the largest town, was recently burnt; but has been partially rebuilt. It contains probably 4,000 inhabitants. Central City, Placerville, and Pioneer are well-built mining towns, containing about 1,000 inhabitants each. Salmon river has been the scene of two wild mining excitements. One in 1862, at Florence, on Meadow creek, where 8,000 or 9,000 miners collected—to leave in as short time as they assembled. The town contains at present about 200 persons. The other excitement was at Lemhi this summer, where 7,000 to 8,000 miners collected—to scatter as suddenly, except some 800 or 900 who had claims, or who could not get away. The valley of the Clearwater is a large and fertile agricultural valley, the home of the Nez Percés Indians. Lewistown, Oro Fino, and Elk City were once flourishing places; but now contain only a small population. Lewiston, from its situation at the confluence of the Clearwater and Snake rivers, the head of navigation, must in time become a place of importance. Warren's Diggings have a considerable mining population.

The portion of the Territory drained by Clark's Fork of the Columbia has a milder climate than is found farther south, and corresponds to the Yocko and Bitter Root valleys in Montana.

There are three lakes of considerable size in Idaho, the Cœur d'Aline, about 24 miles long, and 2 or 3 wide, very irregular in form; the Pen d'Oreille, a crescent-shaped lake, about 30 miles long, and 5 broad; and the Boatman about the same length, and 6 miles wide. The Pen d'Oreille and Clark's Fork are practicable for steamers for 80 miles.

The discovery of the Owyhee mines led to the building of Boonville, Ruby, and Silver cities. Boonville was built first, and depended on placer mines; it is now nearly deserted. Ruby City was both a placer and vein mining town; at present it is supported by a few placer and quartz mills, neither increasing nor diminishing perceptibly in population. Silver City is the largest town in Owyhee. It is a picturesque village, neatly packed away among the mountains, in Jordan's cañon, with mines, quartz mills, hotels, stores, dwellings, school-houses, which serve for churches on Sundays, and an active mining population, and will long be a mining town of importance.

SECTION II.

MINES.—DISTRICTS AND SYSTEMS OF MINING.

The mines of Idaho occur in isolated groups separated by long tracts apparently barren in the precious metals. They may be divided into four districts. On the north Oro Fino and Elk City; then east and west, the Salmon river, the Boise basin, and Rocky bar, and in the south the Owyhee mines. Gold was discovered in this Territory on the banks of the Pen d'Oreille river, in 1852, by a French Canadian, but not in paying quantities. In 1860, a company of prospectors discovered the Oro Fino mines, and during that winter 25 men remained there. The mines at Elk City were soon after discovered. In the spring of 1861 1,500 or 2,000 men came to work them. Oro Fino creek has paid in spots for a distance of 20 miles; Rhodes creek and Canal gulch also proved to be good localities, and although no remarkably rich placers were found in 1861–'62 the mines paid very fairly. Since then the discovery of Boise basin, Owyhee, and Montana have drawn the miners from this district. Except at Wassen's diggings, very little is done in this part of the country at present. When wages become cheaper, miners may rework these mines to advantage.*

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*Governor D. W. Ballard, in his annual message to the territorial legislature of 1866–'67, says:

"For the first two years after the settlement of our Territory, Idaho was looked upon only as a theatre for speculation and as a place for a temporary residence, where, by enduring the necessary toil and privations, rapid fortunes might be acquired. The Territory was first peopled by those whose object was the acquirement of a speedy fortune, and this being done to return either to the Pacific or Atlantic States; but this feeling is rapidly subsiding, and the abundant success attending both mining and agricultural pursuits during the past year is fast removing the prejudices that have formerly existed against Idaho as a location for permanent residence.

"The most reliable information on the subject establishes the fact that the yield of precious metals, in the aggregate, for the past year exceeds that of any preceding year. This, in connection with the fact that operations in gold and silver quartz, our principal source of mineral wealth, are as yet only in embryo, is a source of gratification to every one concerned in the future prosperity of the Territory. The ledges already opened and worked uniformly present indications of increasing richness; in not a single instance have there been indications of depreciation in the deposits of mineral wealth. Only a small proportion of the gold and silver bearing quartz ledges already discovered and known to be rich, some of them almost fabulously so, are as yet being worked. From observations made during the past summer by intelligent and scientific gentlemen, the conclusion is drawn that these ledges, which have yielded so abundantly during the present year, will next year produce still greater profits, while many more will be successfully opened, and their yield be found equally abundant.

"Agricultural pursuits, for two years almost totally neglected, have been prosecuted during the past year with the most gratifying results Many hundreds of acres in the Boise valley and other localities have been brought under cultivation, and it is cheering to learn that the yield per acre, of both cereals and vegetables, will compare favorably with the yield of any other locality on the Pacific coast. The day is not far distant when but little, if any, of the productions raised on the Pacific coast will be brought over the Blue mountains for the support of the people of Idaho Territory. Arrangements for more extended operations in both mining and agricultural pursuits are already in progress for the ensuing year. The amount of land cultivated this year will doubtless be more than doubled next, and it is safe to estimate that equal success will attend the mining interests of the country. In connection with

Salmon River.—In the fall of 1861 some prospectors discovered the mines at Florence, at the head of Meadow creek, a small northern tributary of Salmon river. The situation was remarkable. The deposits of gold were in a marsh on the top of a mountain, in the centre of a basin called Meadow creek. This singular depression is nearly circular, about 12 miles in diameter, and surrounded by high mountains, except an opening to the south. The mountain on which the mines are situated is granite, nearly circular at its base, rising from 500 to 1,000 feet, and about four miles across. From its top a number of flat, marshy ravines ramify in every direction. They are from 20 to 150 yards wide, and filled with peat and muck to depths of 2 to 20 feet. Under this was a stratum of rough unwashed gravel, which had evidently never been much moved. This contained the gold and was very rich, the best parts yielding a dollar to a panful of gravel. Very little black sand was visible. A careful search failed to result in the discovery of any quartz or other vein at the head of the richest ravines. About 1,000 claims were located on this mountain, and paid largely for a short time. Suddenly, however, they gave out, and no more gold was found. On Meadow creek the placers were more enduring. On some of the bars of Salmon river fair wages were made by the miners, at the lowest stages of water for several years, but, unless some discoveries should be made hereafter, mining will probably never pay permanently in this part of the Territory.

A variety of pine grows in this region from six to eight inches in diameter at the ground, with a height of 60 to 70 feet. So dense is the growth that it is difficult for a horse to pass between the trees, which are nearly of the same height, and present the appearance of a field of grain. They are remarkably straight and excellent for building houses or timbering mines. The winter of 1861 was very severe in Florence. For several months all supplies were brought from the Mountain House, a distance of 11 miles, on the backs of men who travelled on snowshoes.

Lemhi.—Last fall some mines were found on branches of Salmon river, not far from Fort Lemhi. Exaggerated reports of their richness caused quite an excitement. The probability is the reports were circulated for the purpose of selling claims. It is said one claim offered for sale prospected well in the snow above the earth. Accounts are conflicting as to the value of these discoveries, but all agree that there are some half-dozen claims on each of four or five gulches which will pay well. Some assert that these are all; others maintain that Lemhi abounds in extensive placers which will yield $5 per day to the hand, though it is generally conceded that they will not justify working at present, except in a few of the gulches.

Boise Basin is a very rich placer district, well timbered with forests of pine, and well supplied with water. Mining is in a prosperous condition here; the flumes are substantially built, and the hydraulics of the most approved construction. These mines were discovered in August, 1862, by a party from Walla-Walla, under the direction of a man named Grimes, on a branch of Moore's creek,

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the agricultural interests of the Territory, it is not uninteresting to know that an enterprising farmer of Boise valley, during the past summer, cultivated sorghum with the most successful results.

"While the two principal pursuits of our Territory, mining and agriculture, have thus been prosecuted with efficient energy and success, all other industrial pursuits consequent upon them have been correspondingly remunerative, and it is believed that there are more settled families, more competent business men, more active and worthy working men, such as constitute the bone and sinew of every country, now in our midst who look upon Idaho as their future home than there ever have been at any previous period.

"The idea of extravagant speculation is giving way to patient toil and well-regulated economy, and, judging the future by the past, this healthier sentiment on the part of the people will gradually increase until Idaho will abound in all the fixtures and elements of a well-established and properly organized community. As the resources of the country are more and more developed, other branches of industry, hitherto dormant, will doubtless be thrown open for the active and energetic labor of the country. All things considered, the future of Idaho may now be looked upon with more confidence than at any former period of her history."

not far from Centreville.* In a few days after the discovery Grimes was killed by the Indians; his party retreated to Walla-Walla, where they procured re-enforcements, and, returning, built a fort about four miles above Centreville. There they remained through the winter. Soon gold was discovered on Granite creek, Elk creek, and Moore's creek, the outlet to the water of the basin. The mines proving extensive and the gold evenly distributed, a great number of claims were speedily located, and they paid well. For the first year or two the miners did a good business. Timber and water being abundant, they were enabled to work their claims to the greatest advantage. The country rock is granite, and the gravel containing the gold has but little quartz, sand or boulders in it. Generally the quartz veins in the basin are soft; when detached and washed down a short distance in the stream, the quartz is finely pulverized and the gold liberated. In mills these ores are crushed with great facility. A large portion of the soil is stained red by oxide of iron, and contains a small amount of gold. The beds of the creeks and gulches have yielded well, and have, in some instances, been worked over as many as four times. Many of the streams have ancient beds of gravel, doubtless rich, below the present beds. On the sides and tops of the adjacent hills are masses of clay and gravel that yield handsomely. In some instances, as at Placerville, the miners come to a bed of clay, which has been mistaken for the bed-rock. On sinking a shaft through it a rich stratum of gravel is found. Ditches from a mile to seven miles in length have been constructed in the basin; their capacity varying from 300 to 3,000 inches, costing from $10,000 to $30,000. Like the small ditches in California, they have paid the cost of their construction and a profit to their owners. Large ditches generally entail a loss to their projectors. Where a large amount of water is brought into a mining district, the mines, unless very extensive, are soon exhausted. Sixty to 80 cents an inch are the rates charged here for the use of water for 24 hours. In some of the hydraulic claims work is continued day and night, as few or no companies have reservoirs. Where lumber is so abundant the creeks and gulches ought generally to pay to flume. Want of fall is probably the reason why many of them have not been flumed. By the use of similar machinery to that recommended for Alder gulch, in Montana, fluming could be rendered profitable in some cases where it is not now used. Except in the construction of flumes, placer operations in Boise Basin are conducted with considerable skill. Quartz mining has been conducted with different degrees of skill, and with varied success. One company called the Elk Horn is composed of four miners, who all work in the mill and mines, giving constant personal supervision to both, and although their ore is not richer than that of other mines, and their mill nowise superior to the ordinary mills of the country, their enterprise has been uniformly successful. The Elk Horn is a small vein a foot to eighteen inches in thickness; the mill in the same ratio, having only five stamps. This correspondence of the mill to the actual resources of the mines is doubtless a prominent cause of success. The best yield which has been obtained by the company from large amounts of ore is $40 per ton, which, with their economical management, affords a good profit. On Granite creek are a number of veins with quartz so soft that two-thirds of the vein stuff can be washed in a common rocker without any previous crushing.

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* The following particulars relative to the discovery of the Boise and other rich mines in Idaho Territory are derived from an article in the Idaho Times:

"But little was known of the existing wealth of southern Idaho until midsummer of 1862. Even Tim. Goodell, the old pioneer trapper of Snake river and its tributaries, who has, perhaps, travelled every trail in what is now known as Boise, Alturas, and Owyhee counties, was entirely ignorant of the existence of our mineral wealth until 1862, when the first prospecting party of six found their way up the cañons of Moore's and Grimes's creeks. When prospecting at a point about six miles above the place now known as Pioneer City, they were attacked by Indians, and one of their number (Grimes) instantly killed. After hastily burying his remains they left the country, and reached Walla-Walla in the month of August. No time was lost in forming a company of 52 men to return with them and more thoroughly prospect the country. Many of those early pioneers are still with us; among them we might mention the names of J. M Moore, John Christie, George J. Gilbert, Mr. Fogus, James Roache, Green and Benjamin White, R. C. Combs, F. Giberson, William Arts, J. B. Pierce, and J. F. Guiseburry. The party arrived at the forks of Grimes's creek, on the site now known as Pioneer City, about the 10th of October, and as soon as a substantial fort and corral for their horses could be built, a portion of the company returned to the Columbia river for winter's supplies, and the remainder built cabins and prospected during their absence unmolested by Indians. Another company arrived on this creek about the 15th of November, and located mines near the site of Centreville. Messrs. Muford, Standifer, Callaway, and Thatcher were with this party. The latter two gentlemen still reside in that place. A great deal of fault was found with the action of the first party in the number and size of the claims located, hence the origination of the name of Hog 'em for that camp. One very bright morning about the last of October several of the Hog 'em boys took a stroll over the divide between Grimes's and Elk creeks, and found good prospects on the bar on which Idaho City now stands. Returning to their camps in great haste, and not wishing to divulge the secret, they reported having beat a hasty retreat from some huge bears. On the next day they returned, with several others of their party who appreciated the bear story, and insisted on the naming of the gulch at the upper end of Main street Bear run, by which name it is still known. The mines on Granite creek were discovered about the 1st of December by the Centreville party, who also located the site of Placerville, which contained about six cabins partly completed on the 14th day of that month.

"In the month of June, 1863, several miners found their way unto the north fork of Boise river, now known as Rocky Bar, in Alturas county. The first ledges discovered in this camp were the Ada Elmore, Idaho, and New York, which class among the best ledges in that camp.

"Owyhee was discovered in the following fall. But little could be said to the public respecting this camp, as its history is spread wide and far, and its exports of bullion amount to hundreds of thousands of dollars monthly. The mining camps of Yuba and Banner districts contain a great number of good ledges. Capital to develop the mines and mills to crush the ore is all that is required to class them among the first of our numerous mining camps.

"The mines of southern Idaho were more speedily populated and developed than perhaps any other mining country ever discovered on the Pacific coast. One year from the time the first party arrived, 5,500 votes were polled within the limits of Idaho. Since that time it has increased and decreased as is usually the case, on account of the fluctuation of our population."

The Pioneer mine, on this creek, is a large vein of soft quartz, containing sulphurets. An extensive mill is nearly completed to work them. If it should prove capable of extracting the gold it will be a very important success, as all gold-bearing veins in the Territory will ultimately produce this ore. The Juniata, about eight miles northeast from Idaho City, has been opened to the depth of 229 feet. This is probably the deepest opening in the basin.

About 25 miles northeast from Idaho City is a district which contains many veins said to be rich in silver. Specimens from there are very prolific in horn and ruby silver, with occasional particles of native silver. There are also specimens containing polybasite and argentiferous galena. All the ores contain gold. These veins are represented as being large, and the ores well diffused through them. They are situated in a dense forest, and are accessible only by a pack train. When wagon roads are built and the mines proved, it will probably be a valuable mining district.

ROCKY BAR.—Rocky Bar, on the Boise river, about 60 miles from Idaho City, is a small, compact district, with many veins in a limited compass. It has been the scene of several enterprises on the part of capitalists from the eastern States, who purchased mines in this locality. The purchasers assert that when opened the mines did not prove good; the parties who sold them maintain that if the affairs of the companies had been well managed the mines would have been successful. Neither of these opinions can be verified by practical examples at present, although many mills have been built and large sums of money expended.

ATLANTA AND YUBA DISTRICT.—No district in the Territory is more favored in respect to the supply of wood and water than the Middle Boise, or as it is now known, the Atlanta and Yuba, situated in Alturas county, 16 miles northeast of Rocky Bar, the county seat, on the Middle Boise river, at the junction of the Yuba. This district embraces the country lying in the forks of the two streams and adjacent. These streams afford magnificent water power for the propulsion of machinery. The new town of Atlanta is here situated on a gentle slope in the valley near the Middle Boise river. Along the base of a lofty mountain called Mount Forsyth, burst forth innumerable hot and boiling springs, throwing out large volumes of water, which, falling into the river, prevent it from freezing or closing with ice during the most rigorous winter. In this district is the Atlanta Ledge, already traced for miles in length, and from 15 to 25 feet in width. Selected ores from this lode assay as high as $11,000 per ton in silver. In some places it is equally rich in gold. The Greenback Mining Company's mill, located at Atlanta, is run by water power, and is now working rock from this lode, although imperfectly, from want of proper appliances and skill. The result, however, is very satisfactory. In the immediate vicinity, and running parallel with the Atlanta, are other lodes which are thought by some to be quite equal, both in extent and richness; such, for instance as the John Bascom and Jessie Benton, the Lusa, the Optimus, the Lenora and Silver Moon, the Tahoma and Greenback on the Atlanta or northwest side of the mountain. On the south or Yuba side are the North Star and Hard-Times, continuations of the Atlanta, and the Sophia Tracy. For working the three last named there is an excellent 20-stamp mill, with modern improvements, now being put up on the ground by J. H. O'Neal and associates. Here also are the Minerva, Olive Branch and Confidence lodes, all of which give promise of value. In some of them gold predominates, in others silver. There are other claims which may, when further developed, prove valuable; but as little work has yet been done upon them no reliable opinion of them can be given. Mr. Graham, in co-operation with an English company, has a 20-stamp mill on the way up from San Francisco, intended to operate in this district. The field for working in quartz, and for exploration and development is extensive. The valley through which runs the Middle Boise river is four miles in length and three in width, and surrounded on nearly all sides by lofty, rough and craggy mountains, some of which are covered with perpetual snow. With the exception of this little valley, and another of lesser size on the Yuba side of Quartz mountain, the whole face of the surrounding country is rough and mountainous, so that the building of roads is a serious undertaking, and the want of them a great drawback to the development of the district. It is only within the past year that a wagon road has been opened. Heretofore, all freight had to be transported upon pack animals. From this cause, less has been done in this camp, and it has attracted less attention than any other of equal value in the Territory. But now that it has become partially accessible, and demonstrated its richness by the working of its ores, it must soon become an important district. The lower hills in the vicinity and surrounding country afford fine grazing for cattle, horses and sheep until the snows of winter, which generally commence in December and last till April. About 20 miles southeast runs the South Boise river, bordering on which are large bodies of bottom and table lands, level and rich, well suited for purposes of agriculture. Oats, wheat and barley in sufficient abundance for the consumption of a considerable population can be produced in this region. It is now covered with a luxuriant growth of grass, from which thousands of tons of hay may be cut. The depredations of Indians in neighboring districts, the mismanagement, the want of skill and proper knowledge of the business, and the incompetency of agents and superintendents, with the misapplication of capital, have done much to retard the development of the Atlanta mines. The regions north and west offer inducements for exploration.*

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*The climate is not rigorous even to the 60th parallel of north latitude. Lorin Blodget says: "To the region bordering on the northern Pacific the finest maritime positions belong throughout its entire extent, and no part of the west of Europe exceeds it in the advantages of equable climate, fertile soil, and commercial accessibility of the coast. The western slope of the Rocky Mountain system may be included as a part of this maritime region, embracing an immense area from the 45th to the 60th parallel, and five degrees of longitude in width. The cultivable surface of this district cannot be much less than 300,000 square miles." (Climatology of the United States, p. 532.)

Owyhee.—Gold was discovered in 1863 by a party under the leadership of a man named Jordan. They first found it about six miles below Ruby City. As the mines were rich, and wood and water abundant, a large number of miners soon collected, and built Boonville, Ruby and Silver cities. The placers paid well for about two years; after that they were almost entirely superseded by vein mining. Most of the mines produce both silver and gold, though these metals vary greatly in their relative proportion in different mines. In the Oro Fino gold predominates; in the Poorman, silver. The placer gold is so alloyed with silver as to be worth but $10 per ounce. West and northwest from Silver City is a vein of porphyry, which forms a mountain about a mile and a half long, half a mile wide, and 1,000 feet high, which is said to assay $3 per ton. All the gulches that head in this mountain have been rich in gold; in some, horn-silver has been found. In Owyhee are two systems of veins. One has a strike nearly north and south, with a dip almost vertical. To this system belong the Poorman and Whiskey veins, with silver predominating. They are probably older than the veins of the other system, but it has not been conclusively proved. The gold-bearing system of veins has a strike northwest and southeast, and a dip to the northeast. To this belongs the Oro Fino, and many others in which gold predominates.

Oro Fino.—The Oro Fino is one of the most productive mines in Idaho. The vein is large and well defined, and the gold generally diffused through the vein-stone. It was discovered in following up a placer deposit to the vein, on each side of the ridges in which it is situated. The first work done upon it as a quartz mine was by Moore and Fogus, who took a large amount of ore from near the surface, which paid handsomely. Becoming involved in other enterprises, they failed, under a heavy indebtedness to their workmen. By an arrangement with other creditors the workmen took the mine, agreeing to pay a certain proportion of the proceeds. Moore & Fogus left it in bad condition for working, and the men who undertook to work it had but limited means. By perseverance, however, they paid off the debt; then opened the mine deeper than it had been opened before, and found a great increase in its richness. The company is known as the "Oro Fino and Morning Star." A recent crushing of 80 tons yielded $160 to the ton; and it is probably now paying the owners a good profit. At a meeting of the stockholders held on the 17th of September last, an elaborate report of the mine was presented, from which the following is extracted.

> Work was commenced in the mine April 28th: since which time two shafts have been sunk of 92 and 67 feet respectively; 1,134 tons of ore have been taken out, and up to the 15th instant 2,050 tons had been crushed, which yielded $54,193. The total amount of expenditures in working the mine, including repairs, incidental expenses, &c., amounted to $45,508, besides other liabilities amounting to $12,476, from which must be deducted about $8,600, value of supplies on hand necessary for supplying the mill, such as fuel, quicksilver, oils, acids, &c., including 7,000 pounds of shoes and dies. The company by-laws were revised and amended; one amendment allows the trustees to expend, for the benefit of the company, any sum under but not exceeding $100,000, instead of $15,000 as heretofore. Altogether, the affairs of the company are in a very healthy state. They are now ready to slope out and work a new level of 70 feet, and consequently they will take out much larger quantities of ore than before. A clean-up from 70 tons of ore last Saturday yielded $10,327, and to-morrow they will probably clean up nearly as much, which, added to the amount above reported, will make an aggregate yield of above $75,000 since the 28th day of April, leaving about $25,000 in the treasury, with everything in good condition for future working.

It is singular that so few mines are owned and worked by companies of operative miners, especially when we see how successful such companies usually are. Nearly all placer mines are worked by such companies, but when a miner works a quartz vein he considers himself relieved from manual labor. The popular belief that "a mill is required to work a mine" has had much to do in preventing companies of miners from working quartz mines. In all extensive mining districts where mills are numerous, miners can sell their ore for all it is worth. Men who make milling their business can manage it better than those who are both miners and mill-men. We see the beginning of this system in California, where the concentrated sulphurets are sold.

POORMAN.—As this mine is, in its location, adverse titles, legal difficulties, and local characteristics, peculiar, it will be described somewhat at length. The Poorman, or Hays & Ray mine, was discovered in the summer of 1865, at or near what is now called the Discovery shaft, about 900 or 1,000 feet south from the rich chimney. The ore at this point was good, though not rich, and the vein somewhat small. While the discoverers were developing their viens, a prospector named Peck found some very rich float-rock about 1,000 feet south of their shaft, and out of sight from its entrance. By a small amount of digging he reached the vein, which he carefully covered over with earth. Gathering up and secreting every rich piece of float he could find, he went where the discoverers of the Hays & Ray were at work, and after "talking round," asked them where their claim was located, and how far it extended in each direction. They showed him their boundaries, and walked directly over the spot where Peck had buried the vein, and such a distance beyond that he was convinced their claim embraced the rich ground. Peck continued to prospect in that vicinity, and cautiously commenced negotiations for the purchase of the mine. Not being satisfied with their figures, and there being few or no prospectors in the neighborhood, he left for a few days, thinking his absence would cause the owners to come down in their price. Before he returned, another company of prospectors found the same spot discovered by Peck, called it the Poorman, and took out silver ore of great richness. Hays & Ray claimed the ground, but as their vein was not uncovered or traced to the new opening, the Poorman company refused to leave, and as the Hays & Ray party had no money to pay for provisions or tools while they were tracing the vein, they gave Peck a share in it for tracing it from their opening into the Poorman. The Poorman party, seeing that they would become involved in litigation, associated their company with some capitalists connected with the Oregon Steam Navigation Company, and about the same time or shortly before erected a fort at their mine, called "Fort Baker," built of logs, with portholes and other means of defence usual in such cases. The Hays & Ray party had their work so nearly completed that they could commence suit, but could not give the necessary bonds. Acting by the advice of Peck, they gave a portion of their interest to the New York and Owyhee Company, the latter guaranteeing to carry the suit to a decision. Before trial a compromise was effected, the New York and Owyhee party getting the larger share. The Poorman, at the start, had the great advantage of possession of the paying part of the mine. The strike of the vein is nearly due north and south; the dip at the surface was to the west, but at the depth of about 150 feet it changed to the east, which is probably the permanent dip. The Silver Cord which is supposed to be on the same vein, at a depth of near 1,000 feet below the Poorman, has also the same dip. A change takes place in the character of the ore, as is usual when the dip changes. A large amount of unnecessary work has been done on this mine; one shaft sunk near the office would have been all that was necessary; but when claims are in litigation much useless work must be done to prove identity of vein. The vein-staff is soft; a great portion being a silicious clay that will dissolve in water. Ordinarily a mill will crush two tons to the stamp in 24 hours. It shows considerable free gold. The sulphuret ores are decomposed except where found in large masses. At the depth of near 250 feet the greater part of the silver is in the form of a chloride. About 100 feet from the surface a body of ore showing partially the planes and angles of a crystal of ruby silver was found, which weighed over 500 pounds. Upon being fractured it showed through the mass a uniform crystalline stratum. There is probably no second example of a similar mass of crystalline light-red ruby silver ore being taken from any mine. A piece of this boulder was sent to the Paris Exposition this year and received a premium of a gold medal. Chloride of silver, or horn-silver, is found in pure masses, with crystals of remarkable size and beauty. It is said sheets of this ore were found more than a foot square and the sixteenth of an inch in thickness, some weighing many pounds. Black sulphurets of silver, or silver glance, is common in the mine; also palybasite. The above enumerates the *ores* of the mine, but it contains also small amounts of the various silver-bearing minerals usually found in rich silver mines. These are generally more interesting to the mineralogist than useful to the metallurgist, by reason of their small quantities.

It is impossible to estimate with accuracy the amount of bullion obtained from the earliest workings of the mine. For a period of three months, from July 23, 1866, to October 23, we have a full account of its operations. The previous work on the mines, pending the litigation, had exposed large bodies of ore, but the working parties were enjoined from removing them. The following statement from the official report of Mr. W. D. Walbridge, the special agent of the company, gives a clear idea of the operations of the company and the results obtained:

> Our first arrangement of working the ore produced was with the New York and Oro Fino mill and our own mill, at the agreed price of $40 per ton for each mill. Subsequently we found that we were producing from our north shaft considerable ore of a poorer quality, which we did not require at the two mills above named, as they were fully employed upon the richer silver ore. We therefore made an arrangement with the Jackson mill to work what we might require of that third-class ore for $30 per ton. Subsequently to this, having more second-class ore than the first-named two mills could work, and to secure the use of a hoisting engine to work our north shaft, we made an arrangement with the Ainsworth Mill Company to use their engine, by agreeing to give their mill all our surplus ore to work upon the same terms as was paid the others. We were enabled to produce ore enough to supply all the mills named, and, by the several arrangements made, were enabled to produce a much larger amount of bullion than we could have otherwise done, the great majority of our ores being too rich for any of the mills to work properly, and keep nearly up to their respective stamping capacity.
>
> We continued to work the mine until October 23, being a period of three months from the time it was opened. During this time we mined about 15 tons of first-class selected ore, which we determined to box up and ship to New York, with the view of its being reduced by the smelting process to increase its yield, we calculating that the cost of transporting the ore would not be any more, if as much, as it was costing us to realize upon our bullion produced in Owyhee. The result has proved that we have lost nothing on the transportation, and have clearly gained, by getting a much larger product in Newark by the smelting process than we could have got in our mills; the cost of smelting at Newark, by Messrs. Balbach, Dieffenbach & Company, being $100 per ton in gold; and, as near as we can estimate, the product in bullion will be about $4,000 per ton in gold; this is upon the ground and dried ore. Aside from that, and from which the foregoing 15 tons of rich ore was selected, we mined 2,382¼ tons second and third-class ore, which was crushed and worked at the four mills named—
>
> | | |
> |---|---|
> | Producing, in refined bullion | $546,691 59 |
> | Deduct total cost of mining, hauling, milling, melting, assaying, and refining, with revenue tax, as per statement marked A, annexed hereto | 156,440 39 |
> | Making net proceeds | 390,251 20 |
>
> To which will be added avails of rich ore now being reduced at Newark.
>
> This amount has been appropriated as follows:
>
> | | |
> |---|---|
> | Reimbursed our company for expenditure on Hays and Ray ledge | $30,000 00 |
> | Reimbursed our company for cost of interest in Hays and Ray ledge | 31,000 00 |
> | Paid our company from second proceeds of mine | 100,000 00 |
> | Paid P. F. Bradford, per agreement | 130,000 00 |
> | Total payments on account of compromise | 291,000 00 |
>
> Leaving for distribution, pro rata, $99,251 20.
>
> The late date at which the settlement with Mr. Bradford was effected, with the seeming necessity of working the mine sharply and vigorously to secure as large a result as possible before the time agreed upon to close the mine, November 1, placed us at much disadvantage as regards costs of working and expenses, so that the expenses last fall should not be considered as any criterion for the future.
>
> At the company's mill we crushed 880 tons of Poorman ore in a period of 78 week-days,

averaging about 11¼ tons for each working day. This was all we could amalgamate in our pans, due partly to a want of quicksilver, and partly to the very long time required to work such very rich silver ore. The want of quicksilver can be easily and cheaply remedied another year; but even then our pans can hardly more than amalgamate in 24 hours what 10 of our stamps can crush in 12 to 14 hours, which is barely more than one-fourth our stamping capacity. Therefore the mill needs more amalgamating pans, by which much more rock can be worked, and more of the stamping force kept employed. We received for crushing the 880 tons of ore, as per statement A, $35,200, which somewhat more than paid the cost; but if we had had ten more pans we could have worked nearly or quite three times the quantity at very little more aggregate expense. In other words, while it cost us nearly $35 per ton to crush, in the given time, 880 tons of ore, with sufficient amalgamating capacity and quicksilver, our mill could work 2,200 to 2,400 tons of ore, at a cost of $18 to $20 per ton, and perhaps less. I would, therefore, recommend you to provide the mill another season with plenty of quicksilver, and about 10 more approved pans, with the necessary separators, to properly and cheaply work the Poorman ore. Quicksilver is always wanted, because it is always wasting by use. The pans, with necessary machinery put up, will cost about $20,000 in gold.

Foreseeing, in July last, the necessity and importance of saving the tailings from almost any gold and silver ore, and especially from the Poorman ore, I ordered a substantial stone wall built around our tailing yard, sufficient to hold securely against flood about 1,500 tons. The cost was about $4,000, and it now contains the tailings from the 880 tons of ore worked in our mill, which assay about $50 per ton. The tailings produced at the Ainsworth and Oro Fino mills belonging to us are safely cared for, and assay about the same. Those from the Jackson mill were lost, being of but little value.

Believing additional settlers in our mill would enable us to save more sulphurets, and catch some quicksilver and amalgam, and, as our amalgamating floor was very small, I determined to build on the north side of the mill a one-story addition, to give us more floor room, room for three settlers and one Knox pan for cleaning amalgam, a store-room for chemicals, and a small room for assaying. This cost about $6,000, answers every purpose it was built for very well, and, I believe, will pay its cost in saving, besides being a very great convenience.

As I looked upon the question of fuel as one which would in the future enter largely into the cost of working ores, I aimed to buy all I could during the fall, at low prices, and left orders with Mr. Peck to contract for cutting upon our land, and land near the mill, at low rates. We had, therefore, on hand, at and near the mill, on January 31, 1,118 cords of wood, which had cost $7,360 62. About 600 cords of this is piled up near the mill, convenient for use; the balance is at different points within one mile; all of it is so scattered as to be in little danger from fire. To be forehanded in our supply will, I believe, enable us to avail ourselves of opportunities to get all we may need cheaply for some years.

Not knowing that working Poorman ore would require so large an amount of quicksilver as was proved to be the case, we found ourselves with a very short supply, though for ordinary use we had sufficient. I was therefore compelled to send to Portland, Oregon, and San Francisco for over 100 flasks to come up by stages, at a cost of $1 15 per pound delivered at our mill. I also purchased wherever I could in town, some of which cost us $1 40 per pound; but with all I could get we had barely enough for effective use on the ore we worked. The need of a full supply was partly the cause of the small quantity of rock manipulated in our own mill. We now have on hand 137⅓ flasks of quicksilver, say 10,986 pounds, valued at 80 cents per pound, or $8,788 80. I would recommend the purchase this spring of as much more, to go out by slow freight, which will cost from 72 to 75 cents, delivered at our mill.

We had but one retort, which unfortunately gave way within two weeks after we commenced working Poorman ore, so we had to rent and use those of our neighbors, requiring us to carry our amalgam a distance averaging nearly one mile, and our bullion the same, and to keep a double force to retort the amalgam, working night and day, being the only way we could keep our small supply of quicksilver at all in hand. I at once ordered two new retorts from San Francisco, but they were so large and unwieldy that they had to come by slow freight via Portland, Oregon, and did not reach us until too late to be of service. I calculate the loss to the company from the breaking of that retort, and having to replace it, at fully $4,000. The cost of new ones delivered at our mill would not exceed $350 each; I would therefore recommend that you provide against the recurrence of such a loss.

* * * * * * * *

Prior to the adjustment of the Poorman controversy, I secured 1,000 feet by location, and 266 feet by purchase, of a newly-discovered ledge lying upon Florida mountain, opposite our mill, at a cost of $2,103 50. The 1,000 feet is so much undivided in a claim of $1,400, the balance is undivided in the adjoining claim.

In addition to the property enumerated in statement marked B is the company's mill property, which consists of one 20-stamp mill, with 10 Wheeler's patent pans; five separators; three settlers; one Knox pan; one office; one boarding-house; one barn; one blacksmith shop; one retort house; one temporary carpenter's shop, all very good for the several purposes used, the office affording sleeping room for two, and an addition to the barn affording storage room for iron and tools. The boarding-house having heretofore been the only accommodation of that kind, as well for officers and millmen, and such guests as we found it to the company's interest to lodge, (which, for several reasons, is in my opinion inconvenient,) I would recommend the building of a moderate house of sufficient capacity to accommodate a few persons, independent of the general boarding-house.

* * * * * * * *

The Poorman mine forms at present the chief value of the company's investment. The New York and Owyhee Company now owns 1,142½ feet undivided in 1,600 of this mine.

Summary of accounts from mine books, February 1, 1867, (in gold.)

EXPENDITURES.		
Construction account—cost of mill	$147,621 63	
Legal expenses	44,575 06	
Mining cost	39,045 31	
Expense account	22,116 00	
Labor account	7,324 41	
Interest account	6,347 10	
		$267,029 51
Woodlands and ledges.		
Noonday ledge	5,897 61	
Eureka ledge	2,974 59	
Stamper ledge	2,103 50	
Woodland and mill site	1,625 00	
		12,600 70
Houses and lots	2,441 75	
Supplies account	16,308 21	
Wood account	7,360 62	
		26,110 58
Bullion account—amount sent to New York	133,942 28	
Drafts on Cosmos and Oro Fino Companies	5,704 69	
		139,646 97
Due the company.		
Cash in agent's hands	2,318 06	
Bills and debts receivable	7,496 06	
		9,814 12
		455,201 88

RECEIPTS.	
Drafts on treasurer	$278,760 85
Poorman mine	166,888 33
Due by the company.	
Bills and debts payable	9,552 70
	455,201 88

Trial balance of the books of the New York and Owyhee Gold and Silver Mining Company, March, 1867.

EXPENDITURES.		
Real estate—cost of mine		$1,050,000 00
Mining account	$278,760 85	
Exchange account	127,223 61	
Expense account	26,063 45	
Interest account	20,832 62	
Insurance on mill	1,425 00	
		454,305 53
Hays and Ray ledge account		87,362 56
Due the company.		
Cash in treasurer's hands	7,236 61	
Debts receivable	20,053 33	
		27,289 94
		1,618,958 03

RECEIPTS.

Capital stock, amount paid in		$1,249,500 00
Stock account, proceeds of sale of 2,500 shares		100,000 00
Bullion account, realized in gold	$133,942 28	
Premium on ditto	64,703 19	
		198,645 47
W. D. Walbridge, agent, realized in gold from ore in part	4,992 62	
Premium in gold from ore in part	1,888 10	
		6,880 72
Due by the company.		
Bonds	50,000 00	
Debts payable	13,781 84	
Outstanding draft	150 00	
		63,931 84
		1,618,958 03

A.—*Result of Poorman mine from July* 19 *to November* 1, 1866.

Name of mill.	Tons crushed.	Crude bullion.	Refined bullion.	Value of bullion.	Average of bullion per ton.	Remarks.
		Ounces.	*Ounces.*			
Jackson Mill	369¼	7,860 20	7,323 29	$25,200 48	$68 25	Mostly 3d class gold rock.
Ainsworth Mill	362¼	34,592 53	33,178 52	62,220 81	171 88	87¾ t'ns 3d cl's, 274½ t'ns 2d.
N. Y. & Oro Fino Mill	771¼	129,542 51	116,753 91	203,586 71	264 05	40 *a* 50 3d cl's, bal. 2d cl's.
N. Y. & Owyhee Mill	880	156,394 25	147,960 17	255,683 59	301 91	All 2d class rock.
Total value				546,691 59		

Whole amount of rock produced and sent to mills.

New York and Oro Fino Gold and Silver Mining Company—accounted for	750¾
New York and Oro Fino Gold and Silver Mining Company—not accounted for	20½
Ainsworth Milling Company, as above	362¼
Jackson Mill Company, as above	369¼
New York and Owyhee Gold and Silver Mining Company, as above	880
Total tons	2,382¾

Cost of hauling 1,133½ tons to Sinker creek, at $8	$9,068 00
Cost of hauling 1,249¼ tons to Jordan creek, at $6 50	8,120 12
Total cost of hauling	17,188 12

Cost of milling 362¼ tons at Ainsworth mill	$13,170 47
Cost of milling 750¾ tons at New York and Oro Fino mill	30,030 00
Cost of milling 369¼ tons at Jackson mill	11,082 07
Cost of milling 880 tons at New York and Owyhee Gold and Silver Milling Co.	35,200 00
Cost of milling 20½ tons at New York and Oro Fino mill (balance)	820 00
Total cost of milling	90,302 54

Total expenses at mine for labor, supplies, lumber, timber, &c., less profit on money, $3,286 99	$38,707 74
Cost of refining and assaying bullion	7,250 01
Internal revenue tax, in gold	2,991 78
Net proceeds of 2,382¾ tons of rock crushed	$390,251 20
Value of bullion per ounce, refined—Jackson mill	$3 44.11
Value of bullion per ounce, refined—Ainsworth mill	1 87.53
Value of bullion per ounce, refined—New York and Oro Fino mill	1 74.38
Value of bullion per ounce, refined—New York and Owyhee mill	1 72.81
Average yield of all rock crushed	229 41
Net yield of all rock crushed per ton	163 34
All charges for mining, milling, &c., per ton	66 07

The net yield of the ores from this mine is wonderful, and is due mainly to their richness. A large amount is left in the tailings. The managers are perfectly aware of this, for at the company's mill, by a well arranged system of reservoirs, all the tailings are saved, so that when the water leaves the last reservoir it is clear and can be used over again. This mill is well constructed and conveniently arranged. The ore is crushed wet and is amalgamated in pans. This collects the free gold, the silver from the chloride of silver, and a portion from the silver glance; but the gold from the sulphurets, and nearly all the silver in combination with sulphur, remain in the tailings. It would probably be unwise to remove the present mill, but in case of building a new one it would be advisable to have it as near the mine as practicable. Last year the cost of hauling from the mine to the mill was $6 50 per ton, a very heavy and unnecessary expense. The Poorman vein shows but few marks of movement on its walls, as might be inferred from its nearly vertical position. It is probable that no faults of great extent will be met in working it. The vein in the widest parts is three feet or more, but its average thickness, from the shaft of Hays and Ray, (as shown in the lower tunnel,) for a distance of 1,100 feet north, is not over a foot. Near the southern end of this tunnel is evidence of another chimney, not so rich, however, as that in the Poorman shaft. Doubtless many more may be found. These, however, are the only chimneys yet developed. The great richness of this vein has caused its examination by many speculative men who never saw a mine before, and who considered that each vein exhibited something miraculous. But nature operates by unchanging laws, and if these gentlemen had examined other mines they would have found the same forces producing the same effects, and have saved themselves the trouble of inventing useless and ridiculous theories.

FLINT DISTRICT.—Flint district is situated about nine miles south from Silver City. It has a number of very promising silver-bearing veins, all containing nearly the same varieties of ore. Polybasite, antimonial silver, and xanthacone are the principal varieties. All these require roasting before they can be reduced by amalgamation. A mill with two small furnaces has been recently erected. The yield of the ore has been very satisfactory. The Rising Star has been well developed. It is a regular vein about 10 feet thick, and contains a large amount of antimonial silver and some gold. This is a very busy mining camp, thickly peopled with miners and all at work. The Iowa and Idaho mill, with a capacity of 15 tons per day, is nearly completed. This mill is intended to work by roasting and amalgamation. In theory the plan is correct. The mechanical arrangements, either as they are or with some modifications, will probably be successful. The altitude of Flint district is 1,000 or 1,500 feet less than that of Silver City, and the climate is milder. Owyhee, being the most southern mining region in Idaho, will receive more directly the benefits arising from the construction of the Central Pacific railroad, which, it is claimed, will be only 90 miles in a direct line from Silver City. Placer and vein tinstone have been found near Silver City. The placer tin was in small quantities. Only three veins containing this metal have been found. Whether the mines when opened will prove valuable is uncertain, but their appearance encourages a trial.

CLIMATE.—The climate of Idaho is greatly diversified by the altitude. In the mines, which are generally high up in the mountains, the temperature is of course much colder than in the valleys. The following memoranda by M. M. Chipman, of Idaho, were kindly furnished by the observer. Full thermometrical tables by the same observer were destroyed by fire:

Copy of weather memoranda.

IDAHO CITY, *July*, 1867.

On the morning of the 12th December, 1865, the mercury of Fahrenheit's thermometer stood at 5° below zero. December 19th, at half past 1 o'clock a. m., at 18° below zero;

but the temperature grew milder immediately afterwards, and the mercury stood at 6° below zero at 7 o'clock a. m.

February 14, 1867.—The mercury stood at 5° below zero at 7 o'clock a. m., and at 2° below at 10 p. m.

February 15, 1867.—5° below zero at 7 o'clock a. m.

February 16, 1867.—3° below zero at 7 o'clock a. m.

The foregoing memorandum shows the coldest periods of the winters of 1865–'66 at this place. During the month of January I do not think the mercury fell below zero. The greatest depth of snow during that winter occurred about the 1st of January, at which time it was three feet deep around this city, but much deeper on the surrounding heights.

April 20, 1867.—I have had a fire in my room this spring throughout every day to this date, with the exception of one which was so warm as to render it unnecessary.

The winter of 1866–'67 was milder than any experienced since the settlement of this (Boise) basin until March, which was a colder month than either of the three preceding, and colder than any preceding March known by the present population.

March 12, 1867.—The mercury stood at 13° below zero at 7 o'clock a. m.

March 13, 1867.—17° below zero at 7 o'clock a. m.

The days mentioned were by several degrees the coldest during the winter, although there were a few other days at about the same time during which, in the latter part of the night and the early part of the morning, the mercury ranged at from 1° to 6° below zero. During the three winter months proper the mercury rarely fell as low as zero. M. M. CHIPMAN.

Quartz Mills.—The following table of quartz mills and water ditches in Idaho, omitting names of owners on account of the frequent changes of ownership, is from Langley's Pacific Coast Directory. The increase in number during the past year (1867) has been comparatively small. Notices of the new mills, constructed or in progress, and of the ditches, are given in the descriptions of the districts:

Table of quartz mills, with their location, name, cost, date of erection, number of stamps, &c.

Name of mill.	Location.	Cost.	When erected.	Number of stamps.	Number of arrastras.	Power.	Gold or silver.
	Alturas county.						
Idaho	Bear Creek		1865	12		Steam.	G. & S.
Waddingham G. & S. M. Co	do			10		do	Do.
Waddingham G. & S. M. Co	Clifden			40		do	Do.
Pittsburg & Idaho G. & S. M. Co	Elk Creek			10	3		Do.
Harris & Benson	Red Warrior Creek			10			Do.
New York & Idaho G. M. Co	do			10		Steam.	Do.
Victor Gold & Silver Mining Co	do			20		do	Do.
Defrees	Volcano			10			Do.
Bledsoe	Yuba District			10			Do.
	Boise county.						
Raymonds	Centerville			10			Do.
Summit Flat	Divide			8			Do.
Elkhorn	Elk Creek			5		Water.	Do.
Bibb, Jackson & Humason	Grimes's Creek			8		do	Do.
Combs & Co	Idaho City			10		Steam.	Do.
Middleton	do			10		do	Do.
Collins & Holliday	Ice House Gulch			12		do	Do.
Cobden Mining Co	Moore's Creek			25		do	Do.
Gates	do					do	Do.
Van Wyck				5		do	Do.
Langdon's							Do.
	Owyhee county.						
Lincoln	Golden Creek			20		Steam.	Do.
Cosmos	Jordan Creek			10		do	Do.
Martin & Co	do			20		do	Do.
Minear	do	$40,000		5		do	Do.
Morning Star	do	75,000		8		do	Do.
New York & Oro Fino	do			10		do	Do.
New York & Owyhee	do	120,000		20		do	Do.
Shoenbar	do	100,000		10		do	Do.
Vass & Morse	do	10,000		4		do	Do.
Ainsworth	Sinker Creek			10			Do.
Grenzeback	do			10			Do.
Webfoot				5			Do.

Water ditches, with the location, source of water, length, &c., of each.

Name of ditch.	Source of water.	Miles in length.
Boise county.		
Alderson	Alderson Creek	3
Bannack	Bannack Bar	1½
Big Ditch		6
Buena Vista	Buena Vista Bar	3
Centerville		
Christa		8
Deer Creek Ditch Company's	Deer Creek	
Goldstrup & Company's		9
Grimes Creek	Grimes' Creek	13
More & Wilson's	More's Creek	7
Pine Creek	Pine Creek	5
Placerville		
Upper Creek		
Wright's		9

PROSPECTING FOR MINES.—All miners are prospectors to a certain extent, but in all mining communities on the Pacific slope there is a class whose sole business is to prospect for new mines. By long experience these men acquire a degree of skill that appears like instinct. As far as they can see a mountain they can determine with great accuracy the probabilities of its containing metals of value. If the hills are smooth and the points are rounded off, placer gold may be found, but not where the hills are bare rock with sharp angular projections. If there is granite, slate, porphyry, or limestone, metalliferous veins may be found, but if the rocks are volcanic it is useless to look for anything valuable where it prevails exclusively. The color of the earth is also an important consideration; over a metalliferous vein there is usually a strip of the earth, about the width of the vein, different in color from the surrounding earth.

The outfit for either quartz or placer prospecting is the same, except a difference in tools. Sometimes a single man goes, but usually from 2 to 12 men go in a company; the latter number only in a hostile Indian country.

Each man has a saddlehorse, and every two or three men a packhorse for the purpose of carrying their provisions, cooking utensils, mining tools, and blankets. In very stormy weather a tent is sometimes added to the outfit.

Cooking utensils consist of a camp kettle, coffee pot, frying pan, tin cups, and knives. The food is bacon, beans, self-rising flour, sugar, and coffee. These, with a Colt's revolver, Henry rifle, or a double-barrelled shot-gun, constitute the armament.

A properly organized party will subsist for months at a time, and traverse a country hundreds of miles in extent without fresh supplies.

For placer prospecting the tools are a pick, pan, shovel, and axe. For quartz or vein prospecting, a palepick, (a pick at one end and a hammer at the other,) shovel, horn spoon, iron mortar, magnet and eyeglass, a few vials of acids, ammonia and solution of salt, and some mattrasses and test tubes. When the prospector can use the blowpipe he always carries it, with a few reagents. The use of the pick and shovel is too well known to require description. The mortar is used to reduce the rock or ore to a fine powder, which is worked in the horn spoon to test it for gold. Very minute particles of gold can be detected in this manner, especially where a magnifying glass is used. The eyeglass is also useful to examine pieces of rock.

If the rock is suspected to contain silver, it is heated in a fire to as high a degree as the means in a wild country will admit, and if very rich the silver melts and forms globules, which adhere to the rock when cold. This test is not very certain, as lead and antimony behave in the same manner and are generally associated with silver, so that the presence of one is a strong indication of the others. Another method is to pulverize a portion of the rock, boil it in a mattrass with nitric acid, and allow it to settle. To a portion of the clear liquor in a test tube an equal portion of a strong solution of common salt is added. If the rock contains silver not in the form of a chloride, a white precipitate is thrown down, which an exposure to the light for a few hours changes to a purple, and in process of time turns black. Other metals, as lead, antimony, and zinc, form a white precipitate, but it does not change its color by exposure to light. If the rock contains copper, a portion of the solution with twice the amount of ammonia added turns a deep blue. By these means the presence of gold, silver, copper, and lead can be determined, which, with tin and quicksilver, constitute the list of valuable metals on the Pacific slope. The blowpipe, with a delicate pair of scales and the requisite reagent, will determine any known mineral, so that with some little experience any compound of the valuable metals can be easily identified.

After a party in search of placer mines arrives in a district reported to be rich and where the appearances are favorable, they select a camping ground near some spring or stream of water where their horses can get grass, and proceed to explore the country. Smooth, well-rounded hills and beds of gravel, either near a stream or on the side or top of a hill, are good indications; also quartz veins and boulders. The dirt from the top of the earth is tried by washing in a pan. If it prospects well the discovery is made, but if it shows nothing, or too small an amount to pay, a pit is sunk down until a change is observed in the color or consistency of the gravel, or until the bed rock is reached. On the bars of streams the sand and gravel near the surface are finer and lighter than further down, the gold corresponding; the greatest deposit being on and in the bed rock near its surface. In hill diggings sometimes for the depth of 70 feet the gold is found about equally distributed the whole distance. If gold is found in sufficient quantities a district is organized and a town springs up. But if after the sinking of pits no satisfactory prospect is found, the party move on.

Prospectors often move too soon. When gold is found even in small amounts, the pits ought to be sunk to the bed rock before it is abandoned. Frequently a body of hard clay or cement is taken for the bed rock, not only in prospecting but in working, as at Carpentier's bar in Montana. Some skill is required to select the best place to sink a pit. In most gulches a skilful prospector can select points in which if no gold is found it is almost certain that there is none in it. The best points are where a ridge of rock extends across the channel of the stream and where the gravel is shallow. If a place can be found where the gravel and soil are not more than two feet deep and the bed rock is rough, and on a thorough prospect entirely across the channel no gold is discovered, it is exceedingly probable that none exists in that gulch, or at least near that portion of it. In prospecting for bar claims the most favorable points are where the stream now makes a bend where it formerly ran across. What are called "hill diggings" are beds of gravel deposited by ancient streams when the general level of the country was higher than at present. They are often found under solidified streams of lava, as under Table mountain in California.

Perseverance is a cardinal virtue in a prospector. Many mines are said to be discovered by accident, as in Alder creek, where the prospectors sank a pit, but the prospects appearing too small the party concluded to abandon it except one, who said he would try "one panful of dirt more." The result was the discovery of the richest mines in Montana. At Florence, in Idaho, a man left in camp while the rest of the party were away prospecting, saw some gravel on the root of a tree in a swamp. Trying a panful he discovered what is known as the Salmon River mines.

Skill and experience are absolutely essential in this branch of mining. Any mountain not volcanic is liable to contain valuable metalliferous veins. They are found in rough and high mountain cliffs, but apparently not as abundantly as in those with smooth outlines. Quartz prospectors follow the foot of a mountain range and examine the sand and gravel in the beds of streams. These beds are generally dry in summer, which renders examination comparatively easy. If the gravel consists of granite, or slate with quartz pebbles, they follow up the stream, breaking open every piece of quartz to see if it contains anything valuable. As they ascend the quartz is more abundant and the pieces become larger until reaching a certain point, where no more is found in the bed of the stream. This shows that the vein is not above but in the sides of the stream, which are now carefully examined.

The vein generally crops to the surface and is easily found. But when it is covered with soil, trenches are run through it down to the bed rock, at right angles to the supposed course of the vein. This is not done unless the quartz fragments, called "float quartz," are rich in some valuable metal.

Often, though many veins are found in one locality, each sending down large quantities of float quartz, perhaps only one of them has rich float. Here judgment is required to distinguish between the different varieties of float quartz and veins with quartz almost exactly alike. The skill of some prospectors is wonderful in determining the existence and locality of small veins covered deep under the soil, whose float quartz is nearly identical with that from a larger vein close above it.

In California nearly all the gold-bearing veins are quartz, and the prospectors hardly ever prospect for anything else; but gold is found in paying quantities in slate, as at the Harpending mines, near Fulsom, and the Oro mine, in Bear valley. In Colorado it is found in feldspar, as at the Gregory, Bates, and Bobtail; and in Idaho in porphyry, as in the mountains west from Silver City.

GENERAL REMARKS ON PROVING AND WORKING MINES.—Vein mining for the precious metals will be the principal source from which they will be obtained in the future. The product of placer mines will grow less and finally cease, but the product from vein mining will increase for an indefinite period. If the miners on the Pacific slope could have the benefit of each other's experience, how many millions it would save annually! This not being possible without the aid of a national school of mines, as recommended elsewhere in this report, a few suggestions derived from experience concerning the opening and working of mines may not be inappropriate in view of the undeveloped wealth of Idaho and Montana. Rules of extensive application must be very general in their character, and as the conditions under which each mine is worked necessarily vary, no general rule will exactly apply to every particular case. General rules guard against loss in mining, while particular rules increase the profits.* The first quartz mining in California was by Mexicans in 1849-'50. They introduced the arrastra, and by carefully assorting the ores containing fine gold from the surface, obtained by this slow method very satisfactory results. The Americans, seeing these results, put up large mills capable of crushing vast quantities, expecting to get profits in the ratio of the amount crushed. Not being properly assorted, much of the rock which they crushed was nearly barren, and their machinery, though very costly, failed to extract the gold which the ore contained. Nearly all these enterprises resulted in a loss to the projectors, and for a number of years quartz mining was in great disfavor in California. A few miners continued to work and experiment until they were successful, and quartz mining gradually increased in productiveness until it has become one of the most important interests in the State.

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* An acquaintance with the general results collected and classified by geology must be our first guide in the investigation of mines. This enables the observer to judge whether any particular district should, from the nature and arrangement of its rocks, be susceptible of including within its bosom beds of workable ores. It indicates, also, to a certain degree, what substances may probably be met within a given series of rocks, and what locality these substances will preferably affect. For want of a knowledge of these facts many persons have gone blindly into researches equally absurd and ruinous. (Ure's Dictionary.)

The same changes were observed in the silver-bearing veins in Nevada. First, a season of discovery and excitement, followed by wild speculation and extravagant expenditure; next a time of disappointment and distrust, and this by a general season of prosperity and profit to all well-conducted enterprises. The same changes are taking place in Colorado, Montana, and Idaho, with scarcely any variations, except such as are induced by local causes. It is desirable to know the causes that act injuriously in one locality, so that they can be avoided in another. The conditions under which mines are worked are nearly similar on the whole Pacific slope, and a mode of working that is very defective in one locality must be objectionable in all others which it closely resembles, and a mode of working that experience has proved to be best in a given district, with slight modifications, will be adapted to other districts containing similar conditions. These principles underlie all business transactions, and cannot be violated with impunity. One of the fundamental errors in mining is to make a false estimate of the value of the mine, the amount and richness of the ores, and the cost of extracting them. The richest mining districts contain many veins that will not pay to work, and great care is required to know whether a vein will pay for working or not. Locality is very important: if a vein be situated in a large mining community where labor and materials are cheap and abundant, the cost of working will be greatly less than in new and unsettled districts, where the pioneers must take all supplies with them, or where freights are high or wood and water very scarce as in a sterile region. In old and extensive mining districts the cost of opening a mine, extracting the ore and reducing it, can be quite accurately determined, and its value known by such extensive workings as admit of no serious mistake, especially when it is known what varieties of ore can be profitably reduced by the methods of reduction practised in the district. In new districts, unless freights are very low, mines of gold and silver only will pay to work, and they must be so rich and large that there is no question of the quantity and quality of their ores. If a vein produces rich ore, the next point to ascertain is its size, and what quantity of ore it will yield. First, thickness; if a vein is not four inches or more in thickness its value is very doubtful, unless remarkably rich. Very rarely a vein is discovered like the Oro, in Bear valley, Mariposa county, California, which was not more than two inches thick, but paid wonderfully for a short time, and then gave out. No confidence can be placed in the extent of such small veins, for the extent of a vein is usually in the ratio of its thickness. In working a vein the miner must make an opening three feet wide to allow room for working, and this space must be excavated whether it contains ore or not. Veins are nearly always softer than their walls, and can be excavated for much less cost than the same amount of wall rock. In the three-feet vein nothing but ore is taken out, but in a four-inch vein only one-ninth is ore, and in the most favorable circumstances the ore from the small veins costs nine times as much for mining as the larger, and owing to the hardness of the wall rock, it may be 20 times more. A two-feet vein sometimes requires heavy timbering, but may be worked nearly as cheap as a three-feet one, for the worthless rock that must be broken can be used to secure the mine instead of timber. This is done in larger veins, as all contain barren portions which are used to support the mine, and nothing requires more skill in mining than to leave the barren portion, and excavate that which will pay. The shafts and drifts in a small vein must be the same as in a large one, and the pumps and hoisting machine nearly or quite as costly. It is a general rule that the larger the vein, other things being equal, the less the cost per ton for extracting the ore. For instance, Quail Hill, No. 1 mine, in Calaveras county, California. Here the workmen offered, after the mine was opened, to deliver the ore at the mouth of the vein for 50 cents per ton. This vein is from 70 to 80 feet thick, and well opened. The thickness of a vein cannot be known until it has been opened to a considerable depth, and traced on the surface for the length of the claim, or as far as it can be followed.

Tracing on the surface is more cheaply done than sinking, and more likely to intersect any "chimneys" of ore that may exist in the veins. Extent at the surface is commonly in ratio of depth. Where veins come to an end they usually split into a number of small seams, which disappear as they are followed, but when only one seam is found the vein generally continues. It is important to know the character of the vein, whether it is regular or irregular in size and richness, whether it is full of "horns" or afflicted with "faults." Generally the greater portion of the ore is found in what are called "chimneys" or "chutes," as in the Comstock, which is rich for some hundreds of feet in length, and then for as great or greater distance is barren. Chimneys seldom descend at right angles to the strike of the vein, but dip lengthwise in it, and sometimes leave one claim and extend into another. In estimating the amount of vein stuff in a vein, it is safe to allow 14 cubic feet to the ton, as it is found in the vein; this is more than the formula in the books allows, but it works well in practice. Thus, if a vein is traced for 1,000 feet, and shows an average thickness of one foot, 1,000 feet deep will give 70,000 tons of vein stuff. Few veins of this size pay to follow so deep, and one-half of this amount of vein-stuff or 35,000 tons is all that can be relied on. These calculations in veins that are opened are of great value in estimating the available ore on hand, but in unopened mines they only give a vague idea of what might be in them under the most favorable circumstances. In former times, 2,000 feet was about the working depth of the best mines; but in the future, owing to improved methods of working, the same class of mines will be worked to a greater depth. Some veins get thicker as they are followed down; others get thinner and finally disappear. Generally they are more liable to decrease than to increase in value. The improvements of the present time in mining machinery render the working of a mine much more rapid than formerly, and as much ore can be taken from a mine in 20 years as in 300 when the ore was carried on the backs of men up rude ladders out of the mine. By this rapid method mines can be worked at much less cost than when the work is done very slowly; thus a mine that contains 400,000 tons of ore, at 100 tons per day, will be exhausted in about 15 years, but at 8 or 10 tons per day it will require 150 years, and the cost of keeping the water out and repairing the timbering in the shafts and drifts would give a good profit on any moderate sized mining enterprise. Neither could the ancient miners extract such vast masses of ore as are taken out of the Comstock, without leaving a large portion in the form of pillars to support the walls. Probably no mine was ever worked under the same difficulties as rapidly and efficiently as the Comstock. The great loss has been in the treatment of the ores. If a vein is in a favorable locality for working, has ore of sufficient richness to pay when worked in quantity, has the proper thickness, and is traced on the surface the requisite distance, is opened in depth so as to show a body of ore, and has the same strike, dip, and general appearance of other good veins in that immediate vicinity, and is in range of a good mine, there can be little doubt of its value.

PRODUCT OF IDAHO.—One of the difficulties attending the collection of reliable statistics on subjects connected with the value and yield of mines, is the proneness of interested parties to furnish exaggerated data for speculative purposes. With the most earnest desire to do justice to individuals and companies whose labor and capital are invested in mining enterprises, it is extremely difficult to avoid doing injustice to the public. No government agent can determine with certainty how far the figures furnished by the superintendents and subordinate officers are to be relied upon; and it is impossible to verify statements involving detailed operations and results which have taken place beyond the limits of personal knowledge. Thus, the report of the New York and Owybee Company for March, 1867, shows a very favorable condition of things at the Poorman. A letter from New York, dated in October and published in a late number of the Oregonian, says: "New York and Owyhee Companies' stock, which, soon after the purchase from Bradford last spring of the conflicting interests in the Poorman mine, was currently rated at 80 to 90 cents on the dollar, has for the past three weeks been going down. It was sold last week at 25 cents, and to-day we have heard it offered at 10 cents. How long can this company afford to pay $35,000 per annum in salaries to a few officers and employés at this rate? Or are some few of the large stockholders and knowing ones trying a freezing-out process? These are samples of the general condition of Idaho matters in this city. *Ex uno disce omnes.*" The correspondent of the Oregonian refers to a similar state of things in reference to the Yuba and Atlanta district. It is quite possible there is either prejudice or personal interest in this statement. Various causes already referred to have retarded the development of the Yuba and Atlanta mines; and no greater credit should be attached to the assertions of an anonymous letter-writer than to the reports of parties known to be interested. The richness of the Poorman mine has been well established; whether it has been or now is remunerative or judiciously managed, the stockholders must determine for themselves. These conflicting statements are referred to for the purpose of showing how difficult it is to avoid error. Probably the best criterion of the yield of the Idaho mines in the aggregate is to be found in the statements furnished by the agent of Wells, Fargo & Co. at Portland, and the office at San Francisco. From this source it appears that the shipments to San Francisco of gold and silver bullion received from Idaho, and inclusive of the receipts from the John Day, Powder river, and Washington Territory placers bordering on the Columbia, were as follows during the past four years, viz:

	1864.	1865.	1866.	1867.
Shipments	$6,223,000	$5,814,000	$5,443,000	$4,842,036
Add 10 per cent., the amount estimated to be shipped by other parties, and 10 per cent., the probable amount carried by private hands	1,244,600	1,162,800	1,086 600	968,406
	7,467,600	6,976,800	6,529,600	5,810,442
Deduct for Oregon and Washington, one-fifth	1,493,520	1,395,360	1,305,920	1,162,088
	5,974,080	5,581,440	5,223,680	4,648,354
Add for amounts probably taken out of Idaho by express through Nevada and by private hands	500,000	1,000,000	2,800,000	1,352,000
Total	6,474,080	6,581,440	8,023,680	6,000,354

It is not pretended that these statements and estimates are entirely reliable, but they are certainly worthy of greater credence than unsupported individual assertions. The allowances made for shipments by way of the Hill Beachy route through Nevada are deemed amply sufficient, taking into view that very little treasure was shipped out of Idaho, except by the way of Portland, until the past year, owing to Indian depredations. Many believe that the miners carry out of the Territory more of the precious metals than is taken by the express companies. If this be the case what becomes of the treasure? The same belief is entertained in reference to the product of Montana. Where does the alleged $40,000,000 produced by Idaho and Montana go to? The report of the Director of the Mint shows that the total deposits of gold and silver of domestic production from all sources during the fiscal year ending June 30, 1867, were as follows: gold, $30,805,748 54; silver, $1,056,680 39; total, $31,862,429 93. The amount of bullion exported from San Francisco to foreign ports during the year ending December 31, 1867, was $18,320,818 71; to New York, $23,355,903 45; foreign and domestic, $41,676,722 16; add estimated home shipments by United States assistant treasurer, $6,000,000; total, $47,676,722 16. The total amount of bullion upon which the internal revenue tax was collected, as stated by the Commissioner of Internal Revenue, during the calendar year ending December 31, 1867, was $58,175,047.

If we allow the product of Idaho and Montana to be, as claimed by many, $20,000,000 each, what becomes of the $25,000,000 of gold produced by California and the $20,000,000 of gold and silver produced by Nevada, for nearly all of which we have the direct returns of the express companies?

I am inclined to the opinion that the product of Idaho for 1867 is but little if at all over the amount stated in the table above given; but to guard against injustice a small percentage is added, making the total product $6,500,000. The yield of Montana for 1867 is estimated to be $12,000,000, and it is confidently believed this is not below the actual amount produced. If we once open the way to conjecture by accepting the statement that the miners carry away more treasure in their pockets than the express companies carry in their boxes, by what means are we to arrive at the amount, or at what point is the limit to be fixed? In the absence of proof to the contrary it is reasonable to suppose that the danger of robbery is too great to justify the practice among miners, as a general rule, of incurring such extraordinary risks to evade the payment of ordinary express charges which secure their earnings from the chances of loss. Small amounts doubtless are carried out in the pockets of individual miners; but none of the leading companies working on any considerable scale are apt to incur such risks. It is more than probable that the amount supposed to swell the aggregate production in this way is greatly exaggerated. On the other hand it is the interest of the express agents to magnify the dangers of robbery, and encourage the belief that prudential considerations are in their favor, and all legitimate business is carried through their hands. Between the efforts of the company to monopolize the carrying business, and the indisposition of the miners to incur expense when it can be avoided, it is difficult to arrive at an equitable conclusion. The estimates, therefore, may be far from the truth, but we must rely upon the only available data in preference to mere conjecture. When it comes to a test of the proportion derived from each mine, the statistician is utterly without data, except such as he can obtain from the officers of the company.

WASHINGTON TERRITORY.

SECTION I.

GEOGRAPHICAL MEMOIR.

Until the recent valuable and important acquisition of Russian America, Washington Territory was the extreme northwestern division of the United States. The Columbia river, to its intersection by the 46th parallel north, and that parallel continued eastward to its intersection of the Snake river, mark the southern boundary and separate it from the State of Oregon. The Snake river to its confluence with the Clearwater, (Kooskooskie,) and a line due north from the mouth of the latter river to the 49th parallel, bound it on the east and separate it from Idaho. The north and northwest boundaries are defined by the Treaty of Limits between the United States and Great Britain, (June 15, 1846,) and are "westward along the said 49th parallel of north latitude to the middle of the channel* which separates the continent from Vancouver Island, and thence southerly through the middle of the said channel and of Fuca's straits to the Pacific ocean." On its west is the Pacific. Its area closely approximates to 70,000 square miles.

The special natural features of the Territory, common to it as a whole, are the Cascade range of mountains, and the great river of the West, the Columbia, which, first traversing its whole breadth and setting off nearly a third of its area, forms a southern boundary and drains the remaining two-thirds of the Territory.

THE CASCADE MOUNTAINS.—The continuous range of mountains known as the Sierra Nevada in California, bears the name of Cascade range through Oregon, Washington, and British Columbia. The name originates from the numerous beautiful cascades which pour from every crevice, at every height, and sometimes even from the top of the steep bluff sides of the gorge in these mountains through which the mighty Columbia forces its way to pour its volume of water into the Pacific ocean. With the exception of the lofty snow-peaks, Ranier, St. Helen's, Baker, and Adams, but few points in this Territory attain an elevation above the snow-line, about 5,000 feet. Estimates have been made of the altitude of several of these peaks, but they have either diminished in height or else were over measured. The humiliation of the lofty Mount Hood by barometric measurement to two-thirds of its former accredited proud altitude, discourages the assertion of claim for the majestic Ranier, and estimated altitudes are omitted.

The range as it passes through this Territory bears slightly northwest and southeast. Several rivers passing through or taking their rise in these mountains afford eligible passes for the construction of roads. Among these may be named the Skagit River pass, Cady's pass, or that following the Skywamish, the northern confluent of the Snohomish river; the Snoqualmie pass, or that following the river of that name; Cedar River, or Yakima pass, long improperly called Snoqualmie pass; the Nachess pass, the Nisqually, and the Cowlitz passes. The exploration of several of these passes is now in progress, (fall, 1867,) under the auspices of the Northern Pacific Railroad Company. The work has been intrusted to the efficient management of General James Tilton, civil engineer, formerly surveyor general of the Territory, and a report of the results will be submitted to Congress at its coming session, (winter, 1867–8.) As accurate instrumental measurement is the only satisfactory demonstration of the eligibility of these passes as lines of communication, it is useless to anticipate authentic reports by approximate estimates. It is proper, however, to add that in 1854 a congressional appropriation of $20,000 was expended on a road from Wallula to Fort Steilacoom via the Nachess pass, and that quite an emigration came over it that fall, with wagons. The Indian war commencing the fall of the subsequent year, the road was but little used. Much fallen timber is now an obstruction to its travel, and the freshets of some of the mountain streams have seriously damaged the river crossings and the portions of road on the banks of such rivers. Quite an appropriation would be required to make this a feasible road. The altitude of the Snoqualmie pass is 3,130 feet. The ascent upon the western slope is gradual to within three miles of the summit, when the rise is sudden and abrupt, it being nearly 900 feet in the last three miles. It is pronounced an admirable pass for a wagon road, but for railroad purposes tunnelling would be necessary. The citizens of King county, with commendable enterprise, have opened a wagon road from Seattle to the Yakima valley. A small appropriation by Congress, judiciously expended, would make this road a great and practicable thoroughfare connecting Puget sound with the upper Columbia basin, Idaho and Montana Territories. Parties who have explored Cady's pass and the Cowlitz pass* pronounce them entirely free from any great difficulty, and requiring but little expense and labor, comparatively, to secure good mountain roads. In all of these passes the approaches are reported as of gradual ascent, and the altitudes of the summits much lower than the surrounding hills.

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* Two channels, the Canal de Haro and Rosario straits, between which are the islands of San Juan and the Archipelago de Haro, separate the continent from Vancouver island. The former is the boldest and most direct, and secures what the treaty evidently *intended:* instead of running the 49th parallel west to the ocean, which would have given the south end of Vancouver island to the United States, the latter yielded the whole island to Great Britain, with the free navigation of the straits and channel. The sovereignty of San Juan and the islands of the Archipelago are in dispute; the boundary and area of Washington Territory are in doubt. San Juan island is garrisoned by troops of both nations, their police jurisdiction extending midway between the two camps. The laws of the Territory for the time being are suspended in the islands west of Rosario straits.

THE COLUMBIA RIVER, which forms so large a portion of the south boundary of the Territory, and then traverses its whole breadth from south to north, forms a main artery for travel and transportation from the coast to the great interior, and in the present undeveloped state of roads *via* the Cascade mountains, affords the channel of communication between the inhabitants separated by that mountain chain. It rises in the Rocky mountains, in latitude 50° 20′ north, flows northerly as high as 52° 10′, receiving Canoe river, which has its source just under the 53d degree. The Columbia then deflects sharply to the southward, expanding in 51° north into a chain of small lakes, receiving the waters of the Kootenai in 49° 30′. Just under the 49th parallel the Pen d'Oreille, the great north fork, (Clarke's,) pours its waters into it; then flowing southward, the Spokane river empties into it, and it turns almost due west, the Okinakane flowing into it from the north. Still bending slightly south of west, several tributaries from the Cascade mountains, the principal of which are the Methow, Chelan, Enteathwa, and Wenachee, contribute their waters, when it turns southeastwardly, receives the Yakima, and then joins with its great southern (Lewis) fork, now called Snake river. Flowing then almost due south a short distance to the mouth of the Walla-Walla river, it turns abruptly to the west, and with a generally westerly course flows into Pacific ocean, its volume still increasing from several rivers from the south, and some on the Washington side. The southernmost tributary of its most important confluent, the Snake river, has its rise as low as latitude

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* Since the preparation of the above, the party engaged in the exploration of the Cowlitz, or Nisqually pass, have returned. This pass lies between and connects the headwaters of the Nisqually and Nachess rivers, which flow in opposite directions from the immediate south base of Mount Ranier. The altitude of the summit will slightly exceed 3,000 feet. By a line of levels run by said party this pass can be surmounted by a grade of 65 feet per mile, ascending from the west, and a descending grade of 45 feet on the eastern slope. From the character of the country, the western ascent can be so distributed that in 56 miles of road a grade not to exceed 50 feet per mile can be secured. The direct line to the summit, after leaving the headwaters of the Cowlitz river, is but 16 or 18 miles.

41° north. The easternmost sources of the two main forks are in close proximity to the headwaters of the Missouri, as far east as longitude 111° west of Greenwich. Its mouth is in 124° west longitude. Thus it will be seen that this vast river and its tributaries water and permeate a region embracing 12 degrees of latitude by 13 degrees of longitude. Its great importance must be conceded, when the statement is made that a land portage of only 450 miles is required to connect the navigable waters of the Missouri and Columbia rivers.

Navigability of the Columbia.—From the mouth of the river to the lower Cascades, 160 miles, no obstructions occur to navigation. Sea steamers of heavy draught constantly go to Vancouver, 115 miles from the mouth. By a portage at the Cascades (the railroad is six miles in length) navigation is open to the Dalles, (205 miles from ocean.) Several miles of portage are here required to avoid rapids and falls,* when good navigation is again secured to Priest's rapids, (385 miles from ocean.) Three miles of portage avoids the difficulties at Priest's rapids, when a stretch of good navigable water is secured to Buckland's rapids, (451 miles from ocean.) At the mouth of Methow another interruption occurs, after which the navigation is practicable to Kettle falls, a distance from the mouth of 725 miles. At high stages of water, say between May 10 and July 15, steamboats can ascend from the portage above the Dalles to Kettle falls. The big bend in the Columbia, however, extends the distance so greatly, that White Bluffs, or a point even east of that, must be practically regarded as the head of navigation. A road from such point nearly due north would again strike the river near the 49th parallel, and the river again could be navigated for a distance of over 150 miles, into the very heart of the richest mining regions of British Columbia. Again, connecting by road the mouth of the Walla-Walla river with the mouth of the Powder river, (a tributary of the Snake,) a reach of over 100 miles in Snake river is navigable for steamers.

Natural Divisions of Washington Territory.—The Cascade mountains, varying but little from a north and south course, traverse the Territory at an average distance from the Pacific coast of little over two degrees of longitude, separating the Puget Sound basin and the region watered by the lower Columbia and its northern tributaries from the basin of the Columbia river. The portion east of the Cascades is not very unequally divided by the Columbia river. Three natural divisions are thus constituted. Western Washington finds its synonym in the Puget sound country. Central Washington has attained the name of the Yakima Valley. Eastern Washington is variously termed the Upper Country, sometimes the Walla-Walla Valley, and Spokane Plains; frequently "Colville" is made to embrace a large section of country.†

Western Washington includes the Puget Sound basin, the valley of the Chehalis, the basin of Shoalwater bay, and the country drained by the lower Columbia and its northern tributaries, the principal of which is the Cowlitz. Ridges, spurs of the Cascade and Coast ranges of mountains, clearly demarcate these several sub-divisions, and a diversity of soil, products, and geological conformation ascribe distinctive features to each.

And first of the great inland sea, Puget sound, which, though properly the smallest sub-division of these waters, has become the general cognomen of that vast ramification of waters to which have been given, by illustrious navigators, the names of Strait of Juan de Fuca, Admiralty inlet, Hood's canal, and Puget sound, together with the almost innumerable bays, harbors, and inlets, each enjoying a separate name, and many of which would afford commodious and adequate harbor for the combined navies of the world. Admiral Charles Wilkes,

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*The Oregon Steam Navigation Company have in successful operation a railroad from Dalles to Celilo, 15 miles in length, avoiding the rapids and falls, though a much less portage, if broken, was requisite.

† See Navigable Rivers of Oregon.

(then lieutenant United States navy,) in 1841, in the valuable narrative of the United States Exploring Expedition, of which he was commander, after a minute description of these waters, thus sums up:

> Nothing can exceed the beauty of these waters and their safety. Not a shoal exists within the Straits of Juan de Fuca, Admiralty inlet, or Hood's canal, that can in any way interrupt their navigation by a 74-gun ship. I venture nothing in saying there is no country in the world that possesses waters equal to these. They cover an area of about 2,000 square miles. The shores of all these inlets and bays are remarkably bold; so much so that in many places a ship's side would strike the shore before the keel would touch the ground. The country by which these waters are surrounded is remarkably salubrious, and offers every advantage for the accommodation of a vast commercial and military marine, with convenience for docks, and a great many sites for towns and cities; at all times well supplied with water, and capable of being provided with everything by the surrounding country, which is well adapted for agriculture.
>
> The Straits of Juan de Fuca are 95 miles in length, and have an average width of 11 miles. At the entrance (eight miles in width) no danger exists, and it may be safely navigated throughout. No part of the world affords finer inland sounds, or a greater number of harbors, than are found within the Straits of Juan de Fuca, capable of receiving the largest class of vessels, and without a danger in them which is not visible. From the rise and fall of the tides (18 feet) every facility is offered for the erection of works for a great maritime nation. The country also affords as many sites for water-power as any other.

To furnish a better idea of these waters, and their extent, we append a tabular statement of the *shore* line, prepared by James S. Lawson, esq., the efficient assistant of the United States Coast Survey, now employed in making a survey thereof:

Shore-line of the Straits of Juan de Fuca, Admiralty inlet, Puget sound, Hood's canal, &c., &c., Washington Territory.

I. STRAITS OF JUAN DE FUCA.

	Miles.
From Cape Flattery to Pt. Partridge, Pt. Wilson	161

II. ROSARIO STRAITS, CANAL DE HARO, GULF OF GEORGIA, ETC.

East side of Whidby's island	79.0
West side of Whidby's island, Pt. Partridge to Deception Pass	14.0
McDonough's island	41.0
Main shore, Pt. Gardner to 49th parallel	128.5
Fidalgo island	56.0
Allan's and Barrow's islands	7.5
Gueme's island	16.5
Cypress, Sinclair, Vendovia & Jack's islands	26.0
Lummi and Eliza islands	25.0
Lopez island	34.5
Decatur island	11.0
James' island	4.5
Blakely island	9.5
Frost island	1.5
San Juan island	40.0
Shaw's island	13.0
Obstruction island	2.7
Orcas island	57.0
Jones' island	3.8
Henry island	5.8
Speeden island	5.7
John's island	4.0
Stuart's island	6.0
Waldron island	8.5
Various small islands	26.0
	627.0

III. ADMIRALTY INLET.

(Commencing at line Pt. Partridge, Pt. Wilson to Puget sound.)

	Miles.
Pt. Defiance to Possession sound	67.5
Possession sound to Pt. Partridge	34.5
Blake island	4.0
Gig Harbor to Foulweather Bluff	102.0
Bainbridge island	31.0
Port Ludlow to Pt. Wilson	48.0
Vashon island	47.0
	334.0

IV. PUGET SOUND.

(Commencing at line joining Pt. Defiance and Gig Harbor—embracing all south.)

Main shore, east side, Pt. Defiance to Olympia	49.0
Main shore, west side, Gig Harbor to Olympia	168.0
Day's island	1.3
Hope island	1.3
———	10.5
Herron island	3.0
Stretch	4.0
Anderson	15.5
McNeil	10.4
Kitson	3.0
Fox island	11.5
Allshouse island	2.5
	280.0

V. HOOD'S CANAL	192.0

RECAPITULATION.

I. Straits of Juan de Fuca	161.0
II. Rosario straits, Canal de Haro, Gulf of Georgia, &c	627.0
III. Admiralty inlet	334.0
IV. Puget sound	280.0
V. Hood's canal	192.0
Total shore line	1,594.0

BAYS AND HARBORS.—Neah bay is just inside of Cape Flattery, a harbor affording partial shelter for vessels. The anchorage is good, but there is no protection from northwest winds. It is a mere indentation of the coast, and was called by the early fur traders Poverty Cove. It is now universally called by its original Indian name. About 25 miles east of Cape Flattery is Callam bay, where a California company is now engaged in taking out coal. Port Angeles, farther east, was the site for a while of the custom-house of this district; an admirable harbor after a vessel got into it, and difficult to leave without wind, tide, and other favorable circumstances. It lies immediately opposite to Victoria, and not very distant from the entrance of the strait—two circumstances supposed to control the location of custom-houses, regardless entirely of the interests of shipping. A small town grew up there, but it has not improved much since the custom-house was retransferred to its former location at Port Townsend.

Port Discovery, Port Townsend, Port Ludlow, Port Madison, Port Gamble, Port Blakely, Dwamish or Elliott's bay, Bellingham bay, and many others, each worthy of distinct notice, having become the sites of flourishing towns, extensive milling or mining operations, and as such, so many centres of population, must be referred to hereafter in the recital of the material resources of the Territory, and the chronicle of the progress of settlement—a progress enhanced in many instances by natural advantages.

The Straits of Juan de Fuca terminate at Point Wilson and Point Partridge. Admiralty inlet lies between the strait and Puget sound, and is separated from the latter by the *narrows*, a mile in width and about four and a half miles long, on both sides of which are high perpendicular bluffs, the northeast terminus of which is called Point Defiance, which has been reserved for fortifications. In the narrows the tide runs with great velocity, and a reference to the map exhibiting this narrow channel or *dalles* through which this vast body of water flows and reflows twice every 24 hours, will readily account for that fact.

RIVERS EMPTYING INTO PUGET SOUND.—Adopting the vernacular of the country, and ascribing the name Puget sound to this Mediterranean of the north Pacific, we will commence on the east shore, at the northern boundary, and follow round.

The Lummi river rises in the Cascade range, northeast of Mount Baker, and flowing in a southwest direction receives the Nook-sack from the southeast, and empties into Bellingham bay. It is a large, deep and rapid river. Much excellent agricultural and grazing lands border both of these streams, and settlements to a very limited extent have been commenced. On these streams the color can be obtained anywhere, but at the head waters of the Nook-sack coarse gold has been found, some specimens being nearly as large as a pea. The dense undergrowth in the river bottoms, but more probably the disgust following the Frazer river excitement, has created that apathy among the citizens of Whatcom which has heretofore prevented a thorough prospect from being made.

The small river or creek, Whatcom, gives name to the town through which it passes. It affords excellent water power, and at its mouth is located the saw-mill of Mr. Henry Reeder, now a member of the legislative assembly from that county.

Next south is the Swinamish, rising in the Cascades and emptying into Bellingham bay. The Swinamish is more properly a pass connecting two parts of the channel. Next south is the Skagit river, rising in the Cascade range, north of the 49th parallel, and emptying into Port Susan by several mouths. For some six miles its navigation is obstructed by large drifts of logs, the collection of years, above which it can be navigated some 50 miles. The valley of the Skagit has already become noted for its extensive and rich agricultural lands. A few settlers have already taken claims. The timber consists of cedar, spruce, fir, &c., upon the uplands, and alder, maple, and cottonwood in the bottoms. With little expense the drifts at its mouth could be removed, and a fine valley extending some 60 miles into the interior, affording excellent farms for many, would be opened to settlement.

The Stit-a-quamish also empties into Port Susan. The timber which skirts its banks is very valuable. Traces indicate the presence of extensive coal beds about 20 miles from its mouth. No attempt, however, has yet been made to develop them. The mouth of this river is obstructed with timber drifts, which removed, navigation for scows, rafts, or boats of light draught could be secured for 25 miles. One or two inconsiderable streams flow southeast into the sound, when we come to the Snohomish, which empties abreast the south end of Whidby's island. About 18 miles from its mouth it divides into two confluent streams, the north being called the Sky-wamish, and the south fork the Snoqualmie. At the mouth of the Snohomish are extensive cranberry marshes. Like most of the rivers emptying into the sound, tide flats stretch for considerable distance across the mouth of the stream, permeated by numerous channels. At high water there is no difficulty of entrance, but when the tide is out the channel must be strictly followed. After entering the river the banks become higher. During the annual freshet its highest banks are subject to overflow. The average width of this stream is about 90 yards, with tolerable deep water. On this river and both of its confluents there is a large quantity of first-rate agricultural land. An intelligent visitor writes:

> There are in some places large tracts of land, with scarcely a stick of timber standing, possessing a soil as rich as any farmer could desire, while the rich bottom lands, covered with a light growth of vine maple and alder, appear to say, "come and till me, and you shall be well rewarded." In fact, I have no hesitation in saying that the country watered by the Snohomish and Snoqualmie will at no distant day be thickly settled by those who will reap a rich reward for their labor.

The Snohomish and Snoqualmie are navigable for steamers of light draught at all stages of water to within a few miles of the falls on the latter river. The falls of Snoqualmie are about 35 miles from the confluence of that river with the Snohomish. At the lowest stage of water the width of the falls will hardly exceed 10 yards, but when the river is full it amplifies to about 75 yards. By recent measurement of General Tilton, chief engineer Pacific division Northern Pacific railroad, the perpendicular descent is 270 feet. Beyond the falls are several rich prairies of considerable extent. Following the headwaters of this interesting river, we approach the Snoqualmie pass. Following the north confluent of the Snohomish, (the Skywamish,) we find Cady's pass, pronounced by several explorers equal in all respects to its neighbor, the Snoqualmie pass.

The next river of note is the Dwamish, entering the bay of that name, (sometimes called Elliott's bay,) on which the flourishing town of Seattle is located. The Dwamish has two principal confluents, White and Green rivers, both of which have historic importance from being the headquarters of the hostile bands of Indians in the war of 1855–'56. The flourishing settlement upon the former was for a time wiped out after the horrible massacre of October 28, 1855, in which 11 unoffending white settlers, men, women, and children, were surprised at early dawn, murdered, and their bodies shockingly mutilated. The savages carried off such property as was valuable, and then wantonly burned the remainder, together with the dwellings. Some of the bodies were burned, and others were thrown into the wells.

Lake Dwamish, or Lake Washington, lies back of the town of Seattle. Its outlet, about four and a half miles long, called Black river, empties into the Dwamish river. Black river, about half a mile from the lake, receives the waters of Cedar river, which takes its rise in the Cascade mountains, a short distance south of the headwaters of the Snoqualmie. The Cedar River pass, now called the Yakima pass, was long confounded with the Snoqualmie pass, (from which it is between five and seven miles distant,) from the fact that it was traversed by Snoqualmie Indians. Following the north tributaries of the White river to their source, a short distance brings us to the headwaters of the Nachess, a tributary of the Yakima. The valleys of these two streams are the depression to which the name of Nachess pass has been given, over which the military road was constructed by Lieutenant Richard Arnold, United States army, from Fort Walla-Walla to Fort Steilacoom. An extensive and rich agricultural region is found in the valleys of all these rivers, and is fast filling with settlers. Inland navigation to the extent of 30 miles is afforded by the Dwamish and White rivers, the tide extending up the former some 14 miles. On the Black river a vein of coal was opened and worked by the late Dr. Bigelow, and a cargo shipped to San Francisco as early as 1854.

The Puyallup river rises north of Mount Ranier, runs northeasterly, and empties into Commencement bay. It is a fine stream, and by the removal of two or three drifts would be rendered navigable for vessels of light draught to the mouth of the Stuck, which empties into it. At its mouth (Commencement bay) there is an excellent harbor, where shipping can load with hay, produce, or lumber. The valleys of the Puyallup and Stuck afford a large quantity of good agricultural land. The soil in the river bottoms is generally very good, much of it first rate. There is considerable prairie in the vicinity, but mostly occupied by settlers. The bottoms are thinly timbered with maple, ash, balm, willow, &c., and easily cleared. These lands yield heavy crops of wheat, barley, oats, and even corn has succeeded well. Vegetables attain an enormous size. The highlands are generally rolling and well adapted to cultivation. The several tributaries of the Puyallup supply a considerable amount of excellent water-power. Although this valley is covered by the claim of the Puget Sound Agricultural Company, that circumstance has not deterred American settlers from occupying and improving it.

The Nisqually river rises south of Mount Ranier, and at its mouth is the site of Fort Nisqually, a post of the Hudson Bay Company. That company, under the treaty-recognized *alias* of Puget Sound Agricultural Company, claim along the shores of Puget sound from Nisqually river to Puyallup river, back to the Cascade mountains, amounting to 261 square miles, or 167,040 acres. The prairies in the vicinity are called the Nisqually plains, supposed by many to be valuable for pasturage. The best portions have been taken as claims by American settlers, who have no very high opinion of a corporation without a charter, or a claim to land based upon neither occupancy, purchase, nor possession, except in the few spots dotted here and there formerly occupied by their herdsmen or farmers, where but little improvement or cultivation has been attempted. In fact, but a trifling portion was ever used, even as a range for cattle, horses, and sheep. It is well worthy of remark that just before the treaty of June 15, 1846, Oregon then being jointly occupied, under the treaty of 1827, by American settlers and the numerous establishments of the Hudson's Bay Company, the officers of the latter consented to co-operate with the former in the support of the provisional government of Oregon, provided the company could be secured in their occupancy of lands at their several posts. To effect this, a section called the "partnership section" was incorporated into the land law and made a part of the compact or constitution. This compact was ratified by the residents of Oregon (British and American) July 5, 1845. Under its provisions the company recorded their claim at Nisqually as containing 17 sections, or 10,880 acres. And yet under the treaty, ratified within a few months of the time at which they themselves designated the extent of that tract, they now assert a claim to having occupied 167,040 acres.

Next is the Des Chutes river, which empties into Budd's inlet, the extreme head of Puget sound, about two miles from Olympia, the capital of the Territory. Its mouth, named Tumwater, is not only notable for its extensive and valuable water-power, but also from the fact that here Colonel M. T. Simmons, the pioneer American settler north of the Columbia river, located his claim in the fall of 1845.

Several small streams empty into the west side of the sound, but the first river to be mentioned is the Skokomish, which empties into the elbow of Hood's canal, 28 miles northwest of Olympia. This river is formed by two confluents called the North and South forks, taking their rise in the Coast range of mountains and coming together about 10 miles from the mouth of the main river. Upon removing the customary obstruction of collected driftwood, the main stream is navigable its entire length. The Skokomish valley varies from one to three miles in width, with a soil equal to the best bottom land in the western States. The growth in the bottoms consists of alder and vine maple. Union City has been started near the mouth, and several claims have been taken. A great quantity of very desirable land is still vacant. Information derived from surveying parties justifies the statement that the land upon the forks is similar to that upon the river. The average yield to the acre in this valley is as follows: Potatoes, 600 bushels; wheat, 40 bushels; peas, 60 bushels; timothy hay, five tons; oats, 70 bushels.

Into Hood's canal, at different points, from 5 to 30 miles below the mouth of the Skokomish, several streams empty, the valleys of which are marked by the same general features as that of the Skokomish. The good lands are not, however, in such extensive bodies as to invite large settlement.

Along the southern shore of the strait of Fuca several streams empty, which take their rise in the Coast range of mountains. The principal of these are the Dungeness and Elwha, the valleys of both of which are fine agricultural lands. The former is fully settled, and several farms have been taken upon the latter.

RIVERS AND BAYS ON THE PACIFIC COAST.—Passing down the coast from Cape Flattery, at the distance of 28 miles is the mouth of the Quillehute river. It varies in width from 50 to 200 yards, and in depth from 8 to 12 feet. Rapids occur at the distance of three or four miles from its mouth, but canoes ascend for many miles. Four or five miles back from the river is the Cammas prairie, five miles long and about three-fourths of a mile wide. The country is well adapted to grazing and cultivation, and there is but one sharp hill to interfere with opening a good road from the valley of this river to the straits of Fuca. At the mouth of this river the Pacific Mail Steamship Company's steamer Southerner (the old Isthmus) was wrecked December 24, 1854. During the present summer D. F. Brownfield and several others, cutting out a trail from the river to the straits, while following one of the small tributary streams of the Quillehute, discovered a ledge of rock indicating the presence of silver. Specimens of the rock, in an imperfect assay made by Dr. Albert Eggers, of Olympia, showed gold and iron, the former amounting to $9 per ton. In other specimens, tested by Dr. O'Brien, of Port Townsend, traces of silver were apparent. Mr. Brownfield, who went through from the straits to the mouth of the river, describes the region west of the Olympic range as generally level, extremely fertile, and interspersed with prairies containing from 500 to 2,500 acres. The bottom lands of the Quillehute are not only extensive but well adapted to agriculture.

Quenuilt river, a small stream which heads in a lake at the foot of the Coast range, empties into the ocean about four miles north of Point Grenville. In its vicinity are the Indians whose tribal name is ascribed to it, noted in the early history of this coast for hostility to the whites. Such names as Destruction Island and Ponta de Martires, designating localities in this vicinity, are the testimonials of their perfidious cruelty, the evidence of their original character. This river gives name to a variety of salmon, as yet not found in any other locality. They are short, thick, and very fat, and are the most delicious variety of the numerous family of *salmonidæ* which abound in all the waters of this Territory.

There are several other small streams rising in the Coast range, and generally flowing southwest, empty into this portion of the coast. But nothing is reliably known of this section of the country after leaving the coast.

GRAY'S HARBOR AND THE VALLEY WATERED BY THE CHEHALIS AND ITS TRIBUTARIES.—Gray's harbor, discovered by Captain Robert Gray, of Boston, in the ship Columbia, May 7, 1792, and by him named Bulfinch harbor, is a triangular-shaped bay with base toward the ocean, and the apex receiving the Chehalis river. Its south point of entrance is called Chehalis Point; Point Brown, the north cape, received that name from Lieutenant Whidby, of the Vancouver expedition. A bank extends across the entrance, with a passage about three-fourths of a mile wide, carrying from 5 to 11 fathoms of water. Outside the bank is another narrow bar, with some three fathoms of water. From this point the depth increases toward the east, the deepest water being between the points of entrance. The bay is surrounded by mud flats, bare at low water. The mouth of the Chehalis nearly due east of the entrance is distant about 12 miles from Point Brown. The greatest width of the bay north and south is 15 miles, and its area is about 150 square miles. Competent judges have pronounced this harbor equal in every respect to Boston harbor. The Um-tulup, Hokium, and other small streams empty directly into the bay. The main river, however, is the Chehalis, which rises in the Cascade mountains, not far north of the Columbia river, and south of the sources of several of the tributaries of the latter, flows northerly a considerable distance, when it takes almost a due westerly course, receiving a branch from the Boisfort hills, and finds its way into Gray's harbor. Its principal tributaries are the Satsop, Wynoochee, Westican, John's, Black, Skookum-chuck, and Newaukum. This valley is the richest and most extensive body of agricultural land west of the Cascade mountains. Indeed, Chehalis and Lewis counties, and the portion of Thurston drained by these streams, may be pronounced the garden spot of Washington Territory. The valley varies in breadth from 15 to 50 miles. From the mouth of the Satsop through to Hood's canal, closed in by the Black Hills and the Coast range, there is a beautiful open valley some 14 or 15 miles wide. In fact, the whole country from the Chehalis to the head of the sound and the head of Hood's canal is well adapted to farming purposes. Prairie land to the extent of 50,000 acres suited for grazing lies in the vicinity of Gray's harbor, and the rich bottoms skirting all these streams, covered with an undergrowth of alder, maple, &c., so easily cleared, would furnish first-class farms for a vast number of settlers.

The travel from Olympia to Chehalis Point has heretofore been by a road to the "block-house" on the Chehalis river, 60 miles east of the point, and thence down the river in canoes, the total distance being about 90 miles. From the mouth of the Satsop, (40 miles from Chehalis Point,) a road of 30 miles in length has just been opened, securing direct communication with Olympia, at the head of the sound. The Chehalis is navigable at all tides, for vessels of light draught or small river steamers, as far as the mouth of the Wynooche, and at high tide to the mouth of the Satsop, where there is a tidal rise and fall of 18 inches. At the lowest water, for two and three months in the year, shoal places might obstruct navigation; but for eight months no difficulty need prevent ascending as far as Claquato, where the territorial road between Olympia and Monticello crosses the Chehalis river. The Messrs. Goff, of Claquato, have just put on this river a good light-draught stern-wheel boat, and they express the assurance that they can make trips most of the year to Boisfort prairie, some miles above Claquato. All the streams abound with salmon, trout, and many varieties of edible fish. Elk and other game, large and small, are plentiful. Coal has been discovered on the north side of the river, and also upon several of the tributary streams.

SHOALWATER BAY AND THE WILLOPAH VALLEY.—From Chehalis Point, the site of the embryo Chehalis City, a splendid beach at every stage of the tide affords the best of roads to Toke Point, the northern cape of the entrance to Shoalwater bay; distance about 16 miles. Along this road a continuous tide prairie appears, constituted almost entirely of sand, yet yielding the most excellent grass. Shoalwater bay, which is one of the best harbors between San Francisco and the Straits of Fuca, is in the southwest portion of the Territory, separated from the Columbia river by a narrow strip of land. Toke Point lies about 28 miles north of Cape Disappointment. It is about five miles from Toke Point to the southern cape, (Leadbetter's Point.) Two channels with middle sands lying between afford good entrances, the north one being a good beating channel. The bay is full of shoals and flats, and at low tide about half its area is bare; good but narrow channels run throughout its extent, worn by the several streams which empty into it. These flats are covered with oysters, which constitute the chief article of export. Codfish, halibut, and sturgeon are abundant. Several varieties of salmon are also found, and in spring large shoals of small herring enter the bay. The annual shipments of oysters to San Francisco is about 35,000 baskets; about 5,000 baskets more are sent to Portland, Oregon, and other points on the Columbia river. Mr. George Davidson, in his valuable "Directory of the Pacific Coast," thus states the extent of this bay:

> The arm stretching southward towards Baker's bay is 15 miles long from Leadbetter's Point, with an average width of not less than three and a half, while the upper portion stretches to the northeast for nine miles to the mouth of the Willopah river, reckoning from the middle of the line joining Cape Shoalwater (Toke Point) and Leadbetter Point.

The same authority, speaking of the peninsula terminating in Leadbetter Point, thus describes it:

> The peninsula is a long, flat, marshy, and sandy plain, elevated but a few feet above the level of the sea, and covered, like the entire surface of the country, with a dense growth of gigantic forest trees, principally spruce, fir, and cedar, with a few specimens of maple, ash, and black alder. The spruce frequently attains a diameter of eight feet.

Several rivers empty into this bay, among which are the Palux, Nasal, and Willopah. The principal one is the Willopah, in the valley of which is a numerous and one of the oldest settlements in the Territory. This river enters the bay at its northeast corner. The lower river is bordered with tide lands which are subject to overflow; the uplands are well adapted to grazing. It is a mile wide at its mouth. The tides extend to the rapids, 17 miles from the mouth. A considerable number of prairies skirt the river at intervals, and the bottom is a rich deep soil of a clayey character. The bottoms are covered with vine maple and alder, and extend above the rapids to a distance of about 20 miles, and are about 10 miles in width.

THE WASHINGTON TRIBUTARIES TO THE LOWER COLUMBIA.—The mouth of the Columbia is now reached. An extended notice of this river has already been made, and the reference to settlements along its shores will necessarily exhibit further features of the country bordering upon it. The same may be said of the streams flowing into it from the north, a particular description of several of which will be omitted. The Cowlitz river being a part of the line of travel from Columbia river to Puget sound, deserves particular mention. This river having its source in the Cascade mountains, between Mounts Ranier and St. Helens, runs west, then south, and empties into the Columbia about 50 miles from its mouth. It runs the whole length of Cowlitz county, and nearly the whole breadth of Lewis, through good agricultural land, both prairie and bottom. The Cowlitz farms, the Cowlitz prairie, and the Cowlitz landing are familiar as household words, and date their origin long antecedent to the commencement of American settlement. The first name alludes to the claim of the prairie by the

Puget Sound Agricultural Company, and the area for which the United States is requested to pay, under the treaty of July 1, 1863, with Great Britain, is 3,572 acres, or nearly six square miles. The Americans, however, have squatted on this claim, until the occupancy of the company has been reduced to 75 acres. On this prairie the Catholics established a missionary station, where recently a town has been laid out in acre lots. Here, too, was the site of the old Red river settlement of Canadian French, introduced in 1842 under the auspices of the Hudson's Bay Company. The landing was the point where the portage commenced, on the old route from Fort Vancouver to the northern establishments. To that point, about 30 miles from the mouth of the river, they navigated it with batteaux and canoes, which were cordelled up the stream. Along the eastern shore were two trails, one used at low and the other at high stages of the water. The Cowlitz river is still a link in the chain of direct communication between the Columbia river and Puget sound. It is a large rapid stream, at high stages of water navigable for steamers of light draught above the old landing, and for most of the year to "Pumphrey's," about 24 miles from its mouth, where steamers frequently run. A boat is now being built, and will be placed on the river this fall, to run from Monticello to the old landing, connecting with the steamers to Portland, Oregon.

In Clarke county there are several tributaries of the Columbia, the principal of which are Cath-la-poole and Washougal. The former, made by two forks respectively rising north and south of Mount St. Helens, flows nearly west and enters the Columbia about 80 miles from its mouth. It is a bold, rapid stream, running about 30 yards in its bed. The bottom lands at the lower portion of the river are wide, but narrow as they approach the foot hills of the Cascade mountains. The country is well timbered, occasionally interspersed with small prairies well adapted to grazing. The Washougal empties into the Columbia about 12 miles above Vancouver. A large settlement, to which it gives name, is located in its valley.

THE OLYMPIC OR COAST RANGE OF MOUNTAINS.—Among the natural features of this portion of the Territory, the Coast range of mountains must not be omitted. They are located in the northwest peninsula, between Hood's canal and the Pacific ocean. Mount Olympus, with an altitude of 8,138 feet as estimated by Wilkes, is a snow-capped peak, and may be seen far out to sea. It gives identity to the chain, and the name Olympic is now generally applied to this range. This sierra, for it consists of several peaks, was first seen by Perez, in 1774, who nominated it La Sierra Santa Rosalia. Meares saw it in 1788, and describes it under the name which he gave it, of Mount Olympus. Around and from the base of this main sierra, the numerous mountains descend to hills and spurs, and abruptly terminate on the sandy beach of the ocean in low perpendicular bluffs. It was long supposed that the Black Hills near Olympia were spurs of the Coast range. This, however, is a mistake. Parties have gone through and report that there is an open valley of at least 15 miles in width, separating these two ranges.

CLIMATE OF WESTERN WASHINGTON.—The climate of western Washington is essentially different from that of the portion east of the Cascade mountains. The fact that there is comparatively no winter in so high a latitude may be a matter of surprise. Properly speaking, however, there are but two seasons, the dry and the rainy. The grades of temperature and the accompaniments which in other countries of the same latitude ascribe the features and title to the four seasons, spring, summer, autumn, and winter, are here in great measure obliterated, or at least so dimly marked that the seasons imperceptibly run into each other, and lose their distinctive line of division. It is not unusual for the three winter months to be mild, without snow or ice, the grass growing meanwhile. In February, the weather may occur mild and genial as May, to be succeeded in March or April with our coldest weather. In July and August, days in some portions of which the maximum temperature will reach 90° or 100°, are sometimes followed by cold nights, occasionally accompanied by heavy frost. The rainy season proper begins late in October or early in November, and may be said to continue till the ensuing April. It frequently happens after the first rains that weeks of weather similar to Indian summer occur, and it is seldom that one or other of the months of January, February, or March does not prove continuously mild and clear. The summers of this Territory are unsurpassed in the world. While many days are exceedingly warm, the nights are always cool and refreshing, as if specially intended for wholesome sleeping. In the winter months, six in number, rains prevail. No disappointment should be felt if falling weather occurred some part of each 24 hours, and yet many bright sunshiny days relieve the long-continued rainy season of Washington Territory. Of the 16 winters passed in this Territory, the writer has known but three so severe as to render it essential to house and feed stock. The Indians do not pretend to such acts of providence, and they lose but little of their small wealth from exposure or cold. Rose bushes generally have proved an evergreen, and during the winter of 1860–'61, the hermosa continued to bloom in the garden of the writer till the 25th of January. Such weather is by no means axiomatic, and an improvident farmer may lose his stock if means of shelter and food be not attainable. Those who have followed stock-raising most successfully provide from two to three months' feed as a general rule. While it may not be essential, surely "it is a good thing to have on hand." An average of from 7 to 10 days of freezing weather may be looked for with moderate certainty, when ice may be formed sufficiently thick to bear a man's weight. Under most favoring circumstances, a small pond entirely protected from the wind, or the action of the sun, may be frozen tight enough to permit a day or two of skating to a limited number of persons. Parties fond of sleighing consider themselves especially favored if they are afforded a season of from three days to a week's duration.

From a series of meteorological observations taken at Fort Steilacoom, the following will demonstrate the above statements. The reason for adopting this year is simply because it will be found that the mean temperature of the three winter months comports with the register furnished at the Smithsonian Institute, and used by the Hon. Charles Sumner in his recent exhaustive speech in favor of the purchase of Russian America. In the register used by him, the mean of the winter months for a series of years amounted to 39° 38′. In the year adopted the mean temperature is 30° 70′.

Mean temperature at Fort Steilacoom, Washington Territory, (latitude 47° 07′) for the six months regarded as the rainy season, or winter, together with the amount of rain and snow, and the number of frosts in each month.

	Mean temperature.					Rain.	Remarks.
	Sunrise.	9 a. m.	3 p. m.	9 p. m.	Monthly mean.		
1853.	°	°	°	°	°	*Inches*	
October......	45.25	53.58	62.32	51.19	53.32	6.93	Hoar frost, three times. Frost, once.
November....	40.02	46.07	50.43	43.73	44.63	18.41	Hoar frost, twice. One strong frost.
December....	38.74	44.30	51	44.45	44.94	4.42	1½ inch snow, 23d, morning. Hoar frost, three; frost, one; hard frost, four times.
1854.							
January......	24.64	29.96	37.80	30.02	31.28	8.09	2¼ inches snow. Ice, 1½ inch, (4th.) Snow latter part of 10th; 2½ inches sunrise 11th, and at intervals that day. Snow showers on 12th. Six days without frost.
February	34.17	38.82	48.17	36.42	43	7.57	1st, ½ inch snow. Showers of snow on 10th. ¾ inch on 11th. Snow on 14th. Hard frost, four times. Hoar frost, twice.
March........	35.38	42.36	54.22	40.09	46.08	2.69	Light showers of snow on 10th. Showers of hail and snow on 29th. Two hoar frosts and one hard frost in month.

Mean temperature at Fort Steilcoom, by months, for four years.

Mean of four years: January, 38°.1; February, 40°.7; March, 41°.8; April, 48°.6; May, 56°.6; June, 61°.1; July, 64°.9; August, 64°.0; September, 56°.9; October, 52°.6; November, 46°.2; December, 38°.3; for year, 50°.8; three winter months, 39°.0.

On page 159 of Davidson's "Directory of the Pacific Coast" will be found a series of meteorological observations on the Puget sound, for the years 1855–6–7, of the summer months. Those of 1857 present the following results:

Time.	Means of daily maxima.	Means of daily minima.	Highest readings. (Maxima.)	Range of maxima.	Lowest readings. (Minima.)	Range of minima.	Greatest range of temperature in one day.	Range of barometer.	Rain.	Remarks. (Appended below said register.)
1857.	°	°	°	°	°	°	°	*Inches*	*Inches*	
May (3 weeks.)	71.7	48.4	101.5	46.9	38.5	18.1	46.0	0.52	0.79	Greatest range of temperature during the above period, 63°.
June	78.2	50.7	90.1	29.2	43.0	13.1	36.9	.62	1.19	
July	74.9	51.6	89.2	26.5	46.9	9.3	33.1	.44	0.01	Greatest range of barometer from May 12 to October 13, 0°.79 inch.
August	73.8	51.1	88.0	28.0	47.1	9.7	37.8	.46	0.08	
September	65.5	49.8	76.4	23.3	45.2	8.5	30.8	.73	0.70	A dry season, and marked by a week of remarkably hot weather at the close of May and the begining of June.
October (2 w'ks.)	60.1	48.9	68.7	16.3	43.4	7.8	25.1	.65	0.74	

Mr. Davidson then remarks: "The cerealia generally grows well, but the climate is too cold for maize. During the winter a great amount of rain falls—as much as 60 inches; and heavy weather prevails principally from the southward. It is never cold enough to form thick, clear, solid ice."

In the winter of 1866–7, the United States Coast Survey brig R. H. Fauntleroy was ordered to remain here during the winter with the idea of testing whether winter work was practicable, and to be on the station at the earliest opening of the season. To test the propriety of such order, a meteorological register was kept to show the number of days when work could not be done. Mr. J. S. Lawson, in charge of the work, has kindly furnished an abstract. It shows that not much may be effected by keeping a full crew on duty, but it proves still more the mildness of a Puget sound winter, and how exempt this climate is from fogs.

Abstract of meteorological register United States surveying brig R. H. Fauntleroy, November, 1866, to April, 1867, inclusive.

(Most of these observations were taken at Olympia.)

Month.	Clear days.	Stormy days.		Amount of rain.
		Rain.	Fog or mist.	
				Inches.
November	2	25	3	9,892
December	3	25	3	8,300
January*	7	18	2	7,506
February	2	24	2	5,197
March	22	8	1	0,880
April	22	8	0	2,371

* Snow on four days.

That admirable document, the speech of Senator Sumner, on Russian America, explains the phenomenon, why Washington Territory is gifted with a climate so much milder in winter than places of much lower latitude in Europe or the Atlantic States. His remarks were applied to Sitka, in latitude 57° 03′. With how much more force may they be applied to western Washington, with the Cascade mountains as a natural wall effectually barring out the cold bleak winds from the frozen northeast, and confining the more genial warm currents of air and ocean which the distinguished senator so beautifully describes in the following extract:

> All this is now explained by certain known forces in nature. Of these the most important is a thermal current in the Pacific, corresponding to the Gulf Stream in the Atlantic. The latter having its origin in the heated waters of the Gulf of Mexico, flows as a river through the ocean northward, encircling England, bathing Norway, and warming all within its influence. A similar stream in the Pacific, sometimes called the Japanese current, having its origin under the equator near the Philippines and the Malaccas, amid no common heats, after washing the ancient empire of Japan, sweeps northward until forming two branches: one moves onward to Behring's straits, and the other bends eastward along the Aleutian islands, and then southward along the coast of Sitka, Oregon, and California. Geographers have described this "heater," which in the lower latitude is as high as 81° of Fahrenheit, and even far to the north it is as high as 50°. A chart now before me in Findlay's Pacific Ocean Directory portrays its course, as it warms so many islands and such an extent of coast. An officer of the United States navy, Lieutenant Bent, in a paper before the Geographical Society of New York, while exhibiting the influence of this current in mitigating the climate of the northwest coast, mentions that vessels on the Asiatic side, becoming unwieldy with accumulations of ice on the hull and rigging, run over to the higher latitude on the American side and "thaw out." But the tepid waters which melt the ice on a vessel must change the atmosphere wherever they flow.
>
> I hope you will not regard the illustration as too familiar, if I remind you that in the economy of a household pipes of hot water are sometimes employed in tempering the atmosphere by heat carried from below to rooms above. In the economy of nature these thermal currents are only pipes of hot water, modifying the climate of continents by carrying heat from the warm cisterns of the south into the most distant places of the north. So also there are sometimes pipes of hot air, having a similar purpose, and these, too, are found in this region. Every ocean wind, from every quarter, as it traverses the stream of heat, takes up the warmth and carries it to the coast, so that the oceanic current is re-enforced by an aerial current of constant influence.
>
> But these forces are aided essentially by the configuration of the northwest coast, with a lofty and impenetrable barricade of mountains, by which its islands and harbors are protected from the cold of the north. Occupying the Aleutain islands, traversing the peninsula of Alaska, and running along the margin of the ocean to the latitude of 54° 40′, this mountain ridge is a climatic division, or, according to a German geographer, a "climatic shed," such as perhaps exists nowhere else in the world. Here are Alps, some of them volcanic, with Mount St. Elias higher than Mount Blanc, standing on guard against the Arctic Circle. So it seems even without the aid of science. Here is a dike between the icy waters of Behring sea and the milder southern ocean. Here is a partition between the treeless northern coast and the wooded coast of the Kenanians and Koloschians. Here is a fence which separates the animal kingdom of this region, leaving on one side the walrus and ice fox from the Frozen ocean, and on the other side the humming bird from the tropics. I simply repeat the statements of geography. And now you will not fail to observe how by this configuration the thermal currents of ocean and air are left to exercise all their climatic power. (Vide, p. 29.)

George Davidson, who has already been referred to, and whose works have been consulted in preparing the foregoing memoir, thus briefly but comprehensively gives his view of the coast division of Washington Territory:

> Washington Territory has a climate excelled only by that of California. We know not where to point to such a ramification of inland navigation, save in the British possessions to the northward. For depth of water, boldness of approaches, freedom from hidden dangers, and the immeasurable sea of gigantic timber coming down to the very shores, these waters are unsurpassed, unapproachable.

II. CENTRAL WASHINGTON.—The second natural division of Washington Territory lies between the Cascade mountains and the Columbia river, both of which have already been noticed. The following extract from the geographical memoir embodied in the "narrative and final report of explorations for a route for a Pacific railroad, near the 47th and 49th parallels of north latitude, from St. Paul to Puget sound," by the late Governor Stevens, *charum et venerabile nomen*, will give the best idea of the remaining geographic features of this interesting region:

> Coming now to the country lying between the main Columbia and the Cascade mountains, it may be necessary to describe with some particularity the various streams and their several tributaries flowing into the main Columbia. A glance at the map shows that the general course of these streams is very much to the south, and between them are generally to be found high mountain spurs which run to the Columbia itself, overhanging it many hundred feet. The most considerable rivers are the Yakima, with its Pisko, its Atahnam, its Nachess, its Wenass, and other tributaries.
>
> The Pisquouse or Wenachee river, Lake Chelan and the Chelan river, the Methow river and the Okinakane river may be described as follows: The Yakima rises in the vicinity of the passes of the Cascade range, latitude 47° 15′, from several large and beautiful lakes, and taking a general course to the southeast, runs for 160 miles to its confluence with the Columbia, in latitude 46° 05′. For 25 miles down the stream its valley is only from half a mile to a mile wide; it then widens out in Ketelas plain, which is 10 or 15 miles wide, the river there being 90 feet wide, and about three in depth, but very rapid. Below this plain the river curves gradually to the south, until it receives the waters of the Pisko; then turns again eastward to its mouth. Between the Ketelas and Atahnam, for 30 miles the hills again encroach on the valley, but below that it again widens out to 6 or 10 miles, with numerous branchings among the hills. On the west side, opposite Ketelas plain, three streams, the Pteh-num, Emptenum, and Wenass, rise among the hills separating the main Yakima from its principal branch, the Nachess. These streams are from 15 to 20 miles long, and run through small and fertile valleys. The Nachess rises in the vicinity of the Nachess Pass, and running nearly parallel to the Yakima at a distance of from 15 to 20 miles, joins it after flowing about 50 miles. It has a valley from half a mile to four miles in width. The Atahnam rises about 30 miles south of it, and runs in a more easterly course, emptying about 10 miles below; its valley is smaller than that of the Nachess, but fertile. The Pisko rises among the hills east of Mount Adams, and in size and character resembles the Atahuam. Only two small branches join the Yakima from the north and east, one running through the middle of Ketelas plain from the hills northward, the other running almost directly contrary to the upper Yakima from the hills east of its southerly bend. The Pisquouse and Enteatlhwa, which enter the Columbia near latitude 47° 30′, are at their mouths rapid streams, with high falls as they descend from the hills at the foot of the Cascade range into the deep valley of the Columbia. They are supposed to head in the mountains about 30 miles northwest of it. The Chelan rises in a lake, which is reported by the Indians to run for 30 miles back among the mountains, and approaches to within two miles of the Columbia, into which its outlet falls, by a series of cascades, 350 feet in this short distance, in about latitude 47° 45′.

The Methow rises by several sources in the mountains northwest of Fort Okinagan, and, running southeasterly, empties near latitude 48°. On its upper part there is a fine wide valley; but this narrows to a mile for 10 miles above its mouth. The Okinakane, rising in a long series of lakes north of the 49th parallel, runs nearly south for seventy miles within the Territory, joining the Columbia only eight miles above the Methow. It expands into several small marshy lakes in its course, and is generally slow and deep, but in one place, about 33 miles above its mouth, there is a fall of five feet. Its valley is fine and the hills around well grassed, wooded, and arable. It receives a branch from the northwest, near the falls, which runs through a rough, hilly country, and has some high falls near its mouth.

The Ne-hoi-at-pu-qun is a stream which enters the Columbia opposite Fort Colville. It has a winding course of about 70 miles, and has numerous beautiful prairies in its valley, though the hills around, partially wooded, are also to a great extent arable. None of these rivers west of the Columbia are navigable, except, perhaps, the Yakima for a part of its course at high water. Lake Chelan is doubtless navigable for many miles, but is cut off from the Columbia by the fall of its outlet. Between these rivers are spurs thrown out from the main chain of the Cascades, and extending towards, and in some cases reaching, the banks of the Columbia. Those between the Klikitat and Pisko tributary of the Yakima and between the main Yakima and the Wenachee or Pisquouse rivers are considerable mountains; thus, on the trail pursued by Lieutenant McClellan, the rise from the Klikitat valley to the divide is 2,364 feet, and the descent to the Pisko 2,114 feet, the elevation of the divide being 3,633 feet above the sea. The rise from the main Yakima to the divide separating it from the Wenachee is 4,048 feet, and the descent to the latter stream 4,264 feet; the summit level is 5,750 feet. Here the spur comes upon the river, making the trail difficult. The country north of the great western bend of the Columbia, from the mouth of the Spokane to the mouth of the Okinakane, is much more gentle and less elevated. Great injustice has been done this country by a want of patience and consideration on the part of the gentlemen who have gone over it rapidly in the summer, and who have been over it but once. It is impossible to speak understandingly of a country unless one has had experience and opportunities of observation in countries somewhat similar. Now the most intelligent voyagers and best practical farmers in that country agree in opinion that there is a large quantity of arable land throughout this country, and very superior grazing. This is the opinion of intelligent Indian chiefs, who have themselves made some progress in raising crops, and who are already great stock raisers.

South of the Yakima is a low divide separating its waters from the waters flowing into the main Columbia, in that portion of the river where, after leaving Fort Walla-Walla, it proceeds westward. This divide has a general parallel course to the Columbia, is nearly east and west some 30 miles from the main river, and between it and the Columbia is a large body of arable land, nearly every acre of it adapted to cereals. This country has not come under the observation of a scientific party with instruments in hand, but has been much travelled over by intelligent officers of the Indian service and by the practical agriculturists of the country. Little streams flowing from the southern side of this divide, which is well wooded all through, pass down to the main Columbia, watering the country and furnishing the means of supplying the farm and animals with water.

On the several tributaries of the Yakima, particularly towards its upper waters, the land is rich, and adapted to most of the crops; and so in the valley of the Yakima itself. This valley has been denominated by some a desert and sage plain; sage does occur in spots and small quantities, but much of the country is cultivable and productive. It may be observed that in regard to the whole of this central portion of the Territory it will be necessary to exercise care as to seed time, and farmers will have a disadvantage over those west of the Cascades in their seed time being very much shorter; but with ordinary care as to the putting in seed no danger need be apprehended from droughts. This portion of the country is wooded about half way up from the divide of the Cascade mountains to the Columbia itself, but you pass up the main Yakima 70 miles before you reach the building pine, although cottonwood is found on its banks sufficient for camping purposes; but when you reach the Pisquouse or Wenachee you come to a wooded region which extends to the main Columbia. The forest growth of the upper waters of the Clearwater, and of the main Columbia from above the mouth of the Wenachee, furnishes inexhaustible supplies, which, after being rafted down the streams—that is, the Snake and Columbia rivers—will furnish settlements in the vicinity of those rivers with firewood and lumber at moderate rates. So great are the facilities for rafting that it almost amounts to a continuous forest along the streams. The Blue mountains, which border the Walla-Walla valley on the south, have a general course westward, south of the main Columbia, until they unite with the Cascade mountains, from which flow many streams to the Columbia, to the Umatilla, Willow creek, Butter creek, John Day's river, and the Des Chutes river.

When this interior becomes settled there will be a chain of agricultural settlements all the way from Walla-Walla to the Dalles, south of the Columbia, along the streams just mentioned and north of the Columbia, on the beautiful table land which has been described to border it from the Walla-Walla westward. The Dalles is a narrow place in the Columbia river where the channel has been worn out of the rocks, below which, about 10 miles, is the mouth of the Klikitat river, whose general valley furnishes the route of communication with the main Yakima and the several intermediate streams, the trails pursuing a generally northerly direction. In this Klikitat valley is much good farming land. It is also worthy of observation that gold was found to exist, in the explorations of 1853, throughout the whole region between the Cascades and the main Columbia, to the north of the boundary, and paying localities have since been found at several points, particularly on the southern tributary of the Wenachee. The gold quartz also is found on the Nachess river. The gold-bearing crossing the Columbia and stretching along Clark's fork and the Kutanie river unquestionably extends to the Rocky mountains.

CLIMATE OF CENTRAL WASHINGTON.—The meteorological data at points of known altitude within this region precludes a satisfactory notice of the climate. In the absence of registered observations facts may be stated from which inferences may be drawn.

A. W. Tinkham, a distinguished civil engineer connected with the Northern Pacific railroad survey, left Fort Walla-Walla (now Wallula) January 7, 1854, followed the Columbia river to the mouth of the Yakima, and ascended that river to its sources in the Cascade mountains. To Kle-alum-lake (with an altitude of 3,000 feet, which he reached January 17) he found no difficulty in travelling with horses. At this point the snow was about two feet deep; "30 miles lower down on the river the snow was very light, not over three or four inches deep; the grass was good and exposed, and the Indian horses were in good condition. Extending still further down and reaching Walla-Walla, the horses are ranging in thousands throughout the borders of the valley, with abundant grass, and rarely with any trouble from the snow." From this camp to the 20th of January the snow nowhere exceeded two and a half feet in depth. From lake Kitchelus to the summit (Yakima pass) the snow attained the depth of six feet. Mr. Tinkham remarks:

> Descending, the snow rapidly decreases on both sides of the mountain, on the eastern side, about 35 miles from the summit, amounting to but from one and a half to two feet in depth, and on the western side falling away until, in the short distance of 14 miles, it is only eight inches deep.

It is proper to add that the winter of 1853-'4, when the reconnoissance was made, was an unusually severe winter.

Colonel Thorp, of Yakima county, and one of the earliest settlers in this valley, having lost considerable stock in the very severe winter of 1861-'2, at the next harvest stacked a large quantity of hay. With no accessible market for the article, the stacks still stand. The grass keeping green all winter in his locality, (on the Yakima, about a mile above the mouth of the Atahnam,) his large herd of cattle having had no occasion to be fed, the six or seven great hay stacks stand there undiminished in their original volume; they serve as a reminder of that unusually cold winter. They equally attest the mild temperature of the valleys of Central Washington, and while one cannot fail to commend the prudence of the stock raiser, yet, for the sake of his labor and that so much good hay should not be wasted, would almost wish that real winter would come oftener. Sylvester Mowry, then a lieutenant in the United States army, who had charge of the meteorological observations of the western division of the Northern Pacific railroad, 1853, gives a series of means of observations at each camp between Fort Vancouver and Fort Colville, in the months from July to October, inclusive, to appreciate which the altitudes of the camps should be included. There was no rain in July, three days on which rain fell in August, seven days on which rain fell in September; in October, five days on which rain fell, and snow on the night of 23d and morning of 24th. He notices the great disproportion between the temperature at sunrise and mid-day, and says:

> I have no recollection of a single day on which a fire was uncomfortable during the pre-

ceding and succeeding sunrise. The heat was not generally oppressive, except in the sun, throughout the march.

Governor Stevens, who so thoroughly investigated all these subjects, in solving the great *desideratum* of these times, interoceanic railway communications, thus arrives at the character of the climate in this vicinity, which is quoted with the more satisfaction from the fact that his deductions are substantiated by residents of the Yakima valley. He thus argues:

> Walla-Walla, latitude 46° 03′, longitude 118° 25′; altitude, 1,396 feet; 1½ year—spring, 51°.9; summer, 73°.1; autumn, 53°.6; winter, 34°.1; year, 53°.2. Dalles, latitude 45° 36′, longitude 120° 55′; altitude, 300 feet; 3¼ years—spring, 53°; summer 70°.4; autumn, 52°.2; winter, 35°.6; year, 52°.8. Lapwai, Clearwater valley, latitude 46° 27′, longitude 117°, altitude, 1,000 feet, 2¼ years observations for temperature give—spring, 51°; summer, 70°.3; autumn, 51°.2; winter, 36°.9; year, 52°.4. Of these, the mean may represent the climate of the great plains and of the valleys connected with it up to latitude 49°, which are about of the same or a lower elevation, giving us, for spring, 51°.9; summer, 71°.2; autumn, 53°; winter, 35°.6; year, 52°.7.
>
> With respect to moisture, no record exists for Lapwai; Walla-Walla and the Dalles, however, are drier in climate, as shown by the records. Fort Walla-Walla, 1½ years observations—spring, 6.40; summer. 2.85; autumn, 4.54; winter, 7.10; year, 20.89 inches. Dalles, 3¼ years—spring, 2.63; summer, 0 42; autumn, 4.16; winter, 7.11; year, 14.32 inches. Mean—spring, 4.51; summer, 1.63; autumn, 4.35; winter, 7.11; year, 17.60 inches.

All the crops of the middle States, including corn, can be cultivated successfully in the Yakima valley. This statement is based upon reliable information from settlers who have resided there and farmed for several years past.

III. EASTERN WASHINGTON.—The Columbia river, which bounds this section of the Territory on the west, has already been a matter of extended notice. To present the idea of the vastness of regions drained by it and its tributaries, it was essential to allude to its two main confluents, the Snake (Lewis's Fork) and the Pen d'Oreille, (Clarke's Fork,) as also the area of country through which they flowed. These two rivers have their respective sources far to the south and east of the Territory of Washington, but they cross the whole width of the region under consideration, and in it are their mouths, several of their tributaries, and the largest proportion of their navigable channels.

If the Spokane and Walla-Walla rivers, with their respective branches and confluents, be excepted, the remaining rivers of eastern Washington generally flow into one or other of the two great forks of the Columbia. This section may therefore be considered as the aggregation of the Walla-Walla valley; the basin of the Lower Snake river; the Great Plain east of the Columbia, circumscribed by the big bend of that river and divided by the Grand Coulee; the Spokane river, valley and plains; and the valley of the Pen d'Oreille, under the general term of "Colville."

The Walla-Walla river and its several tributaries, the Touchet, Mill creek, Dry creek, and several small streams which permeate the valley like the branches of a fan, take their source in the Blue mountains, flow westerly, and converge in the main stream, which enters the Columbia just above the northern boundary of Oregon. At the mouth of the river was located the Hudson's Bay Company's fort, Nez Perce, or Walla-Walla. It was built in 1820 by an officer of the Northwest Company, and consisted of a stockade, 200 feet square, 18 feet high, with a broad walk on top, with two bastions at the northeast and southwest angles. The timber used in its construction was drift-wood from the upper Columbia. In the immediate vicinity of the fort are plains of drifting sand, extending back of the river several miles, the only vegetation being wild sage. This fort was a stopping place and depot for the brigade, as the trading parties of the company were termed. In later years it was the supply post and *entrepot* of Forts Hall and Boise and the trapping parties of the interior. Supplies from Fort Vancouver intended for these establishments were forwarded by land from this point, while such as were designed for the upper Columbia were transported via the river. This fort was burned in 1842, and rebuilt with adobes. In November, 1855, shortly after the outbreak of Indian hostilities, it was taken by the Indians and plundered, since which time it has never been occupied by the company. In its vicinity Colonel Kelley, of the Oregon volunteers, had a two days' battle with the Indians who had robbed the fort, gaining a decisive victory over them. In this action the notorious Pu-pu-mox-mox, head chief of the hostiles, was slain.

The town of Wallula now occupies the site of this old, abandoned fort. Being the eastern terminus of the regular established trips of the steamboats of the Oregon Steam Navigation Company, an extensive forwarding business is done here. It may also be considered the port of the city of Walla-Walla, distant some 30 miles east, as also a great distributing point for the rich mining regions of Idaho and Montana.

Whitman's missionary station (Waülatpu) was located on the banks of the Walla-Walla, about seven miles west of the site of the present city of Walla-Walla. It was established by Dr. Marcus Whitman in the fall of 1836, under the auspices of the American Board of Foreign Missions, and broken up November, 1847, by the atrocious murder of its pious and devoted founder, his lovely wife, and nine other American inmates, by a band of perfidous Cayuse Indians.

There is a striking peculiarity about the innumerable streams which flow into the Walla-Walla river. They spread themselves in almost every direction, not only in channels, but over and on top the surface, constituting a most admirable system of self-distributing natural irrigants. To this feature this rich agricultural valley owes very much for its remarkable fertility and producing power. The main streams are skirted by alder, cottonwood, and willow, the only approach to timber in the valley. Distant a few miles, however, the Blue mountains are covered with heavy timber, adequate for all purposes, though it is rendered expensive by the cost of transportation.

Mill creek is worthy of notice, not only because upon its banks is located the city of Walla-Walla, the largest town in the Territory, but also from the remarkable fact that it divides itself into many distinct channels or creeks, spreading out laterally and watering quite an extensive surface, then gradually converging and concentrating into one channel, through which their waters are emptied into the Walla-Walla river. We know of no other such system of irrigation as this provided by bounteous nature for this beautiful region. The valleys of all these rivers and their numerous branches afford abundance of excellent farming lands, yielding heavy crops. The table-lands and surrounding hills are possessed of soil of like character. In consequence of the absence of water, or difficulty of irrigation, which was deemed a *sine qua non* to their successful cultivation, until very recently no attempts were made to convert these lands into farms; but as settlement increases, they are being occupied and very successfully cultivated. For grazing, these tables and side hills cannot be excelled. They are covered with a luxuriant growth of native bunch-grass of most nutritious quality. During the rains of spring it seems to attain its growth, and through the dry season which follows it stands to be cured into the best of hay, preserving its strength and esculent properties all winter. Stock abandon the green grass of the bottom lands to feed upon it, and on it they keep fat all winter. Another noticeable feature in this region is the great number of cold springs bursting out upon the surface, some of which are sufficiently large for water-powers. On the hottest days they retain their coolness, and are many degrees colder than the water in the neighboring streams, to which they are found in close proximity.

But the term Walla-Walla valley, in common parlance, is by no means restricted to the valley of the river of that name. Governor Stevens, in his valuable Geographic Memoir, thus alludes to its boundaries:

> The Snake river forms a great re-entering from the Clearwater to its junction with the Columbia, which re-entering, being bounded on the south by the Blue mountains, has been

named the Walla-Walla valley, although that term properly applies to the immediate system of valleys whose streams connect with the Walla-Walla river itself.

It may be proper to add that the settlers on the Tukannon, Al-pah-wah, and Pa-ta-ha, which are all tributaries of Snake river, would deem themselves outlawed if denied their residence in Walla-Walla valley. In language appreciated in this Territory, this valley, in its most restricted meaning, would find its synonym in Walla-Walla county.

The Snake river, having formed the east boundary of the Territory from the 46th parallel to the mouth of the Clearwater, crosses the entire width of eastern Washington and empties into the Columbia about nine miles north of the mouth of the Walla-Walla. Some 200 miles of its length courses in and around this section. Its main northern tributary within Washington Territory is the Pelouse, which is formed by two main branches, one rising nearly north in the plain of the Columbia, the other in the Bitter Root mountains. The latter, after running west 130 miles, joins the north fork about 12 miles from the mouth of Pelouse. The Falls of the Pelouse, about nine miles from its mouth, are well worthy of remark. The following description is from the pen of J. M. Stanley, esq., artist of the Northern Pacific Railroad Exploring Expedition, (1853:)

> The Pelouse river flows over three steppes, each of which is estimated to have an ascent of 1,000 feet. The falls descend from the middle of the lower of these steppes. There is no timber along the course of this stream, and but few willows or other bushes; yet the soil is fertile, and the grass nutritious and abundant even in winter. The fall of water, which is about 30 feet wide, cannot be seen from any distant point; for, flowing through a fissure in the basaltic rock, portions of which tower above in jagged pinnacles, it suddenly descends some 125 feet into a narrow basin, and thence flows rapidly away through a deep cañon. The distance from the falls to Snake river is about nine miles The valley widens considerably for about half a mile from the mouth of the Pelouse. The home of the Pelouse Indians is near this junction, where they devote much of their time to salmon fishing. The salmon ascend to the falls; but these Indians have a legend which tells of the wickedness of the Indians higher up the country, and how the Great Spirit, in his displeasure, placed the falls as a barrier to the further ascent of the salmon.

Of the great plain lying east of the Columbia, Governor Stevens thus speaks:

> That portion of the great plain lying east of the main Columbia, and which may be regarded as bounded on the north by the Spokane, and on the east by the foot-hills of the Bitter Root mountains, is, for the most part, well watered and well grassed. The eastern half of this portion is exceedingly well adapted to agricultural purposes. The various streams—the Pelouse, the Kamas Prairie creek of the Cœur d'Alene, the Spokane, and Cœur d'Alene rivers—are well timbered with pine, and numerous rivulets and springs are found through that portion of the country, facilitating the progress of settlements, and rendering the whole at once available for agriculturists.

The Grand Coulee, which is the peculiar specialty of this region, commences on the east side of the Columbia, immediately north of the chain of hills which skirt the river in its bend from White Bluffs westward; after running in the same general direction as these hills eastward some 30 miles, it turns sharply to the north, and continues in that direction till it opens again upon the Columbia, some 60 miles below the mouth of the Spokane. The information as to this south arm and mouth of the Grand Coulee is derived from A. J. Treadway, esq., who surveyed several townships in its vicinity during the past summer, (1867,) under contract with the surveyor general of this Territory. He thus describes it:

> The south or southwest end of the Grand Coulee is on the east side of the Columbia, in township 16 N., R. 23 E., at about centre of the range and south side of the township. It extends through ranges 24, 25, 26, 27, 28 east, and then turns nearly to the north. Near the southern boundary of the township is a range of high hills from 1,000 to 1,500 feet high, running nearly east and west, parallel with the township line. In the Coulee are numerous broken or detached ledges of rocks from 10 to 75 or 100 feet high, and from 100 feet to one or two miles in length, running generally in the same direction with the Coulee. Scattered through the valley are numerous mounds of broken rocks seldom more than 10 or 20 feet in height.

Lieutenant Richard Arnold, United States army, of Stevens's Exploration, (1853,) describes the north end as starting from the Columbia 60 miles below the mouth of the Spokane, and moving in a general direction south-southwest. He says:

> The Grand Coulee is about 10 miles wide where it opens on the river at its northern end, which is 100 feet above the water, and gradually widens towards the south; its walls. 800 feet high, are formed of solid basaltic rock, but diminished in height southward as the bottom rose toward the summit of the plain, until in 20 miles distance they ended. Numerous lateral ravines and cañons were seen, running in various directions, some of them containing lakes without outlet, and streams 10 feet wide and two deep.

The portion west of the Grand Coulee bounded by the Columbia is of basaltic formation, sparsely grassed and scantily supplied with water. A large proportion of country east and south of the Grand Coulee is well adapted to grazing and tillage.

The Spokane river empties into the Columbia just below the 48th parallel, and near the point where the Columbia, deflecting sharply from its southerly course, forms the north limb of the big bend of that river to the westward. A few miles within the eastern boundary of the Territory it receives its main confluent, the Cœur d'Alene, the outlet of Cœur d'Alene lake, which is located in that narrow strip of Idaho Territory situate between eastern Washington and Montana. It is to be hoped that the effort now being made to re-annex this strip to Washington will meet with success. It is a useless appendage to Idaho, and if county organization became necessary, the isolation from the body of the Territory and the capital would prove a source of inconvenience to the residents. The reannexation would divest Idaho of incongruous shape, avoid parallels of latitude and imaginary lines as boundaries, substituting therefor mountain chains, and it would render intact a region of country with community of natural feature and resources, and if inhabited at all, its population would depend upon similarity of pursuit.

The Cœur d'Alene river has several tributaries, the principal of which are the St. Joseph's and South Fork. The valleys of the Spokane and Cœur d'Alene are well adapted to settlement, abundantly supplied with timber and water, and affording a large proportion of arable land. This region may be regarded as bounded on the north by Clarke's fork, or the Pen d'Oreille river, which, after leaving Pen d'Oreille lake, (east of this Territory,) runs northwest and enters the Columbia under the 49th parallel. From the Spokane river to the northern boundary the country is heavily wooded, interspersed with valleys, many of which are now occupied by settlers. The extensive prairie, or plain of the Spokane, must not be overlooked; through it passes the wagon road from Walla-Walla to Pen d'Oreille lake. This vicinity is memorable for the short but brilliant and decisive campaign of the late distinguished General George Wright, (then colonel 9th United States infantry,) in the summer and fall of 1858, against a hostile combination of the Spokane, Pen d'Oreille, Pelouse, and Cœur d'Alene tribes of Indians, a large number of whom, on the 16th May previous, had surprised and defeated Colonel Steptoe, of the same regiment, on Snake river. Colonel Wright was sent by General N. S. Clarke to chastise them. On the 1st September he thoroughly whipped them at "Four Lakes," (latitude 47° 32′, longitude 117° 39′,) without the loss on his part of a single man. On the 6th he repeated the lesson at "Spokane plains," (latitude 47° 40′, longitude 117° 19′,) in a fight continuing over seven hours, in which the Indians were driven some 14 miles, two of their chiefs killed, and numbers of lesser note. The prompt and efficient conduct of Colonel Wright forced the Indians to sue for peace. He marched as far as the Cœur d'Alene mission, curtailing their ability for further depredation, and established quiet in that region, which till this time remains. He also gloriously wiped out the humiliation of Steptoe's disaster.

West of the Spokane prairie a range of hills divides the waters of the Spokane and lower Pen d'Oreille. Between these hills and the Columbia are the Colville and Chemakane valleys, separated by a low divide. In the latter was located the missionary station of Rev. Messrs. Eels and Walker, established in 1838, under the auspices of the American Board of Foreign Missions, and successfully conducted till the winter of 1847, when, after the "Whitman massacre," it was abandoned. This valley affords a large quantity of excellent agricultural land, and is capable of supporting a considerable settlement.

The Colville valley derives its name from the Hudson's Bay Company fort of that name, situated near the bank of the Columbia, in latitude 48° 37′. This post was established in 1825, and during the period when the company were in active operation was second only in importance to Fort Vancouver. It was erected upon a terrace about a mile back from the river, and about two miles from Kettle falls, a vicinity formerly noted for the abundance of salmon. The establishment consisted of a dwelling-house, three or four warehouses, a blacksmith shop, and several one-story log houses. In primitive days these were enclosed within a stockade some 70 yards square, with bastions at two of the angles. Nine miles from the fort was the Cattle Ranch; a grist-mill situate on the Stauntehus river, (now Mill creek,) three miles from the fort, where quite an extensive farm was cultivated. This mill supplied the adjacent country and the northern posts with flour, made from the wheat raised in this vicinity by its few settlers, mostly in the company's service, and Indians living within a circuit of 70 miles, who had been instructed in agriculture by the Protestant missionaries, also supplied considerable. This fact alone speaks largely as to the capacity of Colville valley as a wheat-producing region. The batteaux used by the company in the navigation of the Columbia were built at this fort. It was in fact a recruiting station and rendezvous for the company's brigades; the point where the results of trade were consolidated to be transmitted across the Rocky mountains to headquarters in the Hudson's Bay territory, from whence shipments were made to England.

In the immediate vicinity of the fort the soil is sandy, but a short distance back it produces abundant crops. We have no recent meteorological data sufficiently full to make an exhibit of climate; but the assertion is fully warranted that the winters are many degrees milder than in the same latitudes east of the Rocky mountains. Captain Mullan, United States army, who has been thoroughly acquainted with this whole region since 1853, compares the climate of this region with that of St. Joseph's, Missouri, in latitude 41°. The summer is apt to be hot and dry; but little rain falls except in spring and fall. Corn succeeds well, though later in maturing than in the middle States. Wheat, barley, oats, patatoes, melons, &c., yield abundantly.

Colville valley proper is about 50 miles long and three wide, and large quantities of very rich land are unoccupied and open to settlement. Hon. J. E. Wyche, a judge of the supreme court, Washington Territory, but recently returned from holding court at Pinckney City, thus refers to it:

> On the rich lands now unoccupied in the valley and on Mud lake and along on different points on the Columbia river there are now the finest opportunities for settlement and happy and prosperous homes of any part of this upper coast. From 100 to 300 families may find as rich land as the sun shines on, with no timber to be cleared, and with splendid timber just at hand, and the finest streams, and needing only the touch of the husbandman's hand to yield abundant harvests.

Pinckney City, oftener called Colville, has recently been established, and already has a population of over 200. Near it are the United States military post (Fort Colville) and the Indian reservation.

This vicinity has attracted much attention as a gold mining region since 1854; indeed the name of "Colville" has attached to the whole mining region of the upper Columbia and its tributaries, south of the 49th parallel. Gold is found on all the streams and bars from the Spokane river to the northern boundary, and up the Pen d'Oreille to the Catholic Mission. The richer fields of British Columbia have attracted thither white miners, but a large number of Chinamen have found successful employment on these various bars for the past several years.

On the 18th November, 1865, the steamer Forty-nine was launched at the old Hawkins barracks, the former winter quarters of the Northwest Boundary Commission. She is 114 feet long, 20 feet 4 inches wide, and 5 feet deep, with two engines, 12½-inch bore, 4 feet stroke—80-horse power. She was built by Captain Lemuel White, the pioneer steam navigator of the upper Columbia. She runs from Little Dalles, just south of the 49th parallel, to La Porte or Death rapids, distance, by course of river, 270 miles, and within 15 miles of Big Bend, British Columbia.

Little Dalles is an embryo town established on the Columbia, some 30 miles from Pinckney City, with which it is connected by an excellent wagon road. The collector of customs, district of Puget Sound, has located at this point a United States deputy collector. A large quantity of merchandise passes through this place, as is proven by the following exhibit, very kindly furnished by Major J. J. H. Van Bokkelin, who acted in the capacity of deputy collector from March 1, 1866, to December 1, 1866, inclusive:

Value of goods imported by Hudson's Bay Company on which duties were paid at Port Angelos.

Amount of invoices	$4,632 00
Duties paid on same	2,928 21

Statement of goods in transitu from Vancouver's island and British Columbia via Little Dalles.

47 saddle horses, 183 pack animals, merchandise; value	$34,175
From Kootenais, British Columbia, to Vancouver's island and British Columbia: 68 saddle horses, 225 pack animals, 42 packages furs; value	18,560
To Fort Shephard, British Columbia, from Vancouver's island and British Columbia: 34 saddle horses, 167 pack animals: value of merchandise	42,781
From Fort Shephard to British Columbia and Vancouver's island: 38 saddle horses, 195 pack animals, 35 packages of furs; value	18,500

Statement of merchandise shipped from Little Dalles to British Columbia.

From Hudson's Bay Company, Fort Colville: 18 riding horses, 167 pack horses, 28 packages of furs; value	$16,700
From Oregon and Washington Territory, via Yakima valley and Soogoos lake:	
2,754 head of sheep	22,032
2,265 head of beef cattle	148,550
483 head of horses	33,810
43 head of mules	4,300
1,132 head of pack animals	113,200
264 head of saddle horses	26,400

From Little Dalles to Big Bend, British Columbia, via Columbia river—canoes and boats: Vessels cleared at custom house, 19 canoes, 35 boats, 15 trips of steamer Forty-nine; merchandise cleared at custom house, $142,487 25.

RECAPITULATION.

Valuation of merchandise imported into Colville district	$7,560 21
Valuation of merchandise passed *in transitu*	114,016 00
Valuation of animals	83,400 00
Valuation of merchandise, &c., exported	507,479 25

Climate of Eastern Washington.—As the central division may be regarded as the west half of the great plain of the Columbia, the general remarks upon its climate measurably apply to the eastern portion of said plain. Meteorological data from continued observations at known points are not accessible within the time allowed in the preparation of this memoir, and we are forced to content ourselves with a single citation, the mean result of one and a half years' observations: Fort Walla-Walla, latitude 46° 3′, longitude 118° 25′, altitude 1,396—spring, 47°; summer, 73°.1; fall, 53°.6; winter, 34°.1; mean for year, 53°.2.

Captain Mullan, late of United States army, long on duty in this section, in his Military Road report, thus refers to the climate:

> The meteorological statistics collected during a great number of years have enabled us to trace an isochimenal line across the continent from St. Joseph's, Missouri, to the Pacific; and the direction taken by this line is wonderful, and worthy the most important attention in all future legislation that looks towards the travel and settlement of this country. This line, which leaves St. Joseph's in latitude 40°, follows the general line of the Platte to Fort Laramie, where, from newly introduced causes, it tends northwestwardly, between the Wind River chain and the Black Hills, crossing the summit of the Rocky mountains in latitude 47°—showing that in the interval from St. Joseph's it had gained six degrees of latitude. Tracing it still further westward, it goes as high as 48°, and develops itself in a fan-like shape in the plains of the Columbia.

It may certainly be said of the upper Columbia basin, considering its altitude and high latitude, its climate is remarkable for mildness. On the open prairie the snow, never deep, seldom covers the ground a week at a time; in the heavy timber and in sheltered places it remains much longer on the surface. It is seldom essential to house or feed stock, though occasional severe winters serve as warnings to provide food and shelter. One or two months' feed is the extent which necessity ever requires in the heaviest winters. The Indians, who own extensive bands of horses, take no precaution, sometimes shifting their camps for better grass, and they seldom lose stock by occasion of severity of winter. A noticeable concomitant of the winter of the upper Columbia is the Chenook wind; it is a warm current, more properly a gale, occasionally, during the winter months, blowing up through the channel of the Columbia from the southwest. A few hours' continuance will remove every vestige of snow from the earth over which it sweeps.

There is no hazard in the statement that, for health and salubrity, there is no climate in the world which surpasses that of Washington Territory in the two portions east of the Cascade mountains.

THE COUNTIES OF WASHINGTON TERRITORY.—The Territory is divided into 21 counties, viz: Chehalis, Clallam, Clarke, Cowlitz, Island, Jefferson, King, Kitsap, Klikitat, Lewis, Mason, Pacific, Pierce, Skamania, Snohomish, Stevens, Thurston, Wahkiakum, Walla-Walla, Whatcom, and Yakima.

CHEHALIS.—Population, 300; assessed value of property, $100,199 94; area, 1,600 square miles. The geographical position of this county is best defined by referring to its special feature, Gray's harbor, and the valley of the river which confers its name. It lies upon the Pacific, and its north boundary is about midway between Capes Disappointment and Flattery. It was organized by act of the Washington Territory legislature, April 14, 1854. County seat, Montesano; post offices or towns, Cedarville, Chehalis City, Cosmopolis, Elma, and Satsop. It contains a large quantity of rich bottom lands and prairies, and is one of the best agricultural sections of the Territory.

Roads.—Till recently the travel between these settlements, all located upon Gray's harbor or the Chehalis river, was by water. The road from Olympia, on Puget sound, terminated at Cedarville, where canoes were taken for the remaining journey to Gray's harbor, although there were trails along the banks of the river, and one crossing to the Willopah settlement in Pacific county. A road has just been completed from Satsop to Olympia, very materially shortening the distance between the lower Chehalis settlements and the sound. A beach road from Chehalis City to the northern cape of Shoalwater bay connected these settlements with Pacific county and Astoria, Oregon.

CLALLAM.—Population, 305; assessed value of property, $97,396 31; area, 1,720 square miles; number of acres of land on which taxes are paid, 9,300. This county was established by act of Washington Territory legislature, April 26, 1854. Its full northern length is washed by the Straits of Fuca, and its western boundary, about 40 miles in length, borders on the Pacific ocean. County seat, New Dungeness; post offices and towns, Port Angelos and Nee-ah

Bay. Skirting the straits from the east boundary to near Port Angelos there is a wide belt of excellent land, which is very generally occupied by settlers. The river bottoms are very rich, and the opening of the roads from the straits to the Quillehuyte river has developed the existence of a rich section of land heretofore unknown. Most of the travel from place to place is by the straits. A road has been opened from the eastern settlements to Port Angelos, and short roads connect the former settlements with Port Discovery and Port Townsend.

CLARKE.—Population, 2,089; assessed value of property, $611,657; area, 1,400 square miles; number of acres of land on which taxes are paid, 94,731. Acres planted in wheat, 932; in oats, 1,805; in rye, 52; in barley, 78; in peas, 120; in potatoes, 215. Lumber mills, 12; flouring mills, 3; schools, 26; churches, 9; stores, 31. One steam vessel. Horses, 1,039; mules, 87; cattle, 3,980; sheep, 4,463; hogs, 1,469.

This is the oldest county in the Territory. The provisional government of Oregon, June 27, 1844, established the district of Vancouver, embracing all of the then Oregon Territory north of the Columbia river. By act under same government, December 22, 1845, the word "county" was substituted for "district." Under the Oregon territorial government the name of "Clarke" was adopted in place of "Vancouver." County seat, city of Vancouver, one of the most thriving settlements in the Territory. Here was established the headquarters of the Hudson's Bay Company west of the Rocky mountains. The early Catholic missionaries, in 1838, first commenced their labors at this point. Early after the treaty of 1846 United States troops arrived in the Territory, since which time it has been occupied as a military post, long the headquarters of a military division or department.

Towns and Post Offices.—Lake River, Lincoln, Pekin, Union Ridge, and Washougal. The county borders the Columbia river, and is about equidistant from the Pacific ocean and the summit of the Cascade mountains. The settlements are connected by roads, but the main territorial road from Fort Vancouver to Fort Steilacoom, passing along the Columbia river to the Cowlitz, at certain seasons is inundated; from this fact and the facility of travelling on the Columbia this road has only a nominal existence.

COWLITZ.—Population, 480; assessed value of property, $186,079; area, 460 square miles; number of acres on which tax is paid, 20,918.

This county lies immediately west of Clarke, with about 20 miles of shore line on the Columbia river, with 25 miles of length of the Cowlitz river traversing it north and south. Its southeast corner is about 35 miles east of the mouth of the Columbia river. Besides the valley of the Cowlitz several tributaries of that river afford a large quantity of rich bottom land. Nearly one-third of the county is included in these valleys. A short distance back of the rivers large tracts of unoccupied lands afford great inducement for settlement. No portion of the county is further removed from either the Cowlitz or Columbia than 15 miles, hence access to market is insured. The whole county is good soil. Fifty bushels of wheat to the acre is not an unusual yield in these bottom lands. This county was set off from Lewis county by the legislature of this Territory, April 21, 1854. Monticello is the county seat. This is the point of departure for travel from the Columbia river to Puget sound. Castle Rock and Oak Point are the remaining post offices. At the latter point is located Abernethy's saw-mills, at which about 4,000,000 feet of lumber are annually manufactured. There is also a small saw-mill on the Cowlitz river about 12 miles above Monticello.

Roads.—This county is so located that roads from the Columbia river to Puget sound must either commence in or pass through it. Here commences or terminates the land travel between the river and the northern settlements. The military road from Steilacoom and the territorial road from Olympia end here, and the transit to Portland or Vancouver is completed by steamboats via the river. The portion of road between Monticello and Vancouver is located, but scarcely used. The old Hudson's Bay trail, which comes down the Columbia river, may be travelled at certain seasons of the year, and was much used for driving stock, but even they are now most generally transported in barges to Monticello, towed by the steamers. On the east side of Cowlitz river a road is opened connecting all the settlements. From Monticello to Oak Point, and from Oak Point to Boisfort prairie in Lewis county, roads have been opened, the latter connecting with a territorial road from Boisfort to Olympia.

ISLAND.—Population 409; assessed value of property $261,731; area 250 square miles. The following surplus produce remained on hand May, 1867, at time of annual assessment, which indicates the producing character of this settlement: 1,416 tons of hay; 2,687 bushels wheat; 15,815 bushels barley; 9,382 bushels of oats; 5,925 bushels of potatoes; fruit trees, 9,868; horses, 268; cattle, 964; sheep, 1,234; hogs, 1,156.

The county was established by the Oregon territorial legislature, January 6, 1853. It consists of the two islands of Whidby and Camano. The county seat is Coupeville. Towns and post offices—Coveland, Crescent Harbor, Oak Harbor, and Utsalada, the latter of which places is the site of the extensive saw-mill of Messrs. Greman and Craney, on Camano island. While isolated from the remainder of the Territory the settlements on Whidby's island are connected by good roads.

JEFFERSON.—Population, 650; assessed value of property, $301,584 27; area, 1,670 square miles. Established by the Oregon territorial legislature December 22, 1852.

This county has an extensive shore line upon the straits of Juan de Fuca and Admiralty inlet, embracing ports Discovery, Townsend, and Ludlow. It then extends south of Clallam county to the Pacific ocean. On ports Discovery and Ludlow extensive steam saw-mills are located, giving employment to numerous hands and constituting centres of population. Port Townsend, on the bay of that name, is the county seat. It is the site of the custom-house of the district of Puget sound; the marine hospital is located here, and at the head of the bay is the military post, (Fort Townsend.) The bay is six miles long, four wide, and an excellent harbor. Towns and post offices—Chemican, Port Discovery, and Port Ludlow. Water transportation is relied upon, as most of the settlements are in the vicinity of the sound. Roads connect Port Townsend with Port Discovery, and with the prairie settlements back.

KING.—Population, 725; assessed value of property, $414,043; area, 1,800 square miles; acres under cultivation, 3,650. Organized by the Oregon territorial legislature December 22, 1852.

In this county are embraced the rich agricultural valleys of the Dwamish, White, and Green rivers, and the extensive coal fields back of Lake Washington on the Squak, Black, Dwamish, and Green rivers. Seattle is the county seat; a thriving town, in which is located the university of the Territory. Towns and post offices—Cedar river and Freeport.

Roads.—Seattle is connected with Steilacoom by a good wagon road, and during the past season a wagon road has been constructed across the Snoqualmie pass of the Cascade mountains into the Yakima valley.

KITSAP.—Population 610; assessed value of property, $551,266; area, 400 square miles.

This county was organized by act of the legislative assembly of this Territory, passed January 16, 1857, under the name of Slaughter county, in honor of the gallant Lieutenant W. A. Slaughter, United States army, who was killed in the Indian war of 1855–'56. By a provision in the bill the people of the county were authorized to vote for a name at the next general election, (1857.) At such election the name Kitsap was adopted after the Indian chief whose tribe occupied considerable portion of the county, one of the most prominent and able of the leaders of the hostile Indians. The county may be described as the peninsula between Hood's canal and Admiralty inlet, including Bainbridge and Blake's islands, with 50 miles of shore line upon Hood's canal and 80 upon Admiralty inlet. No portion of the county lies further from navigable water than four miles. This county is noted for its extensive lumbering mills. Port Madison is the county seat, on the excellent harbor of that name. Towns and post offices—Teekalet, Seabec, Port Orchard, and Port Blakely.

Roads.—Between Port Madison and Teekalet the portage is made by a road nine miles in length. Port Orchard to Seabec, a distance of four miles, is made over a well-defined trail. Water transportation is the prevalent method of communication between the settlers themselves, as also with other portions of the Territory.

Klikitat.—Population, 300; assessed value of property, $125,342; area, 1,850 square miles; number of acres of land on which taxes are paid, 6,778; established by legislative assembly of this Territory December 20, 1859; county seat, Rockland. The Dalles in Oregon is the post office for this whole region, including even the county seat. The Yakima Indian reservation and the Simcoe agency are located in this county. The Indian industrial school, under management of Rev. J. H. Wilbur, at this agency, has been a decided success.

Lewis.—Population, 550; assessed value of property, $268,095; area, 1,580 square miles. Established by the Oregon provisional government December 21, 1845; county seat, Claquato; towns and post offices—Boisfort, Cowlitz, Highland, Newankum, Saunders, and Skookum Chuck.

This county is one of the best agricultural sections west of the Cascade mountains. Thoroughly watered by the Chehalis and Cowlitz rivers and several of their tributaries, its prairies and rich bottoms offer great inducement to settlement.

Roads.—The territorial road and mail route from Olympia to Monticello runs through the whole breadth of this county. A second territorial road, crossing the Skookum Chuck and Newankum and avoiding the Chehalis river, terminates at the old Cowlitz landing. Boisfort is connected with Claquato by a good wagon road, and also by a road with Mopah, in Pacific county.

Mason.—Population, 219; assessed value of property, $44,480; area, 1,600 square miles. Organized under the name of Sawamish county by the Washington Territory legislature, March 13, 1854. Name changed to Mason, January 8, 1864, in honor of the memory of Mr. Charles H. Mason, deceased, first secretary of the Territory in order of time as well as by efficiency of service, and long and ably its acting governor. County seat, Oakland. Towns and post offices—Arkada, Kamilchie, Skokomish, Sherwood's mills, and Union city. A road has been opened from Oakland, near the head of Skookum bay, to Olympia, which is used for driving stock. Water communication, by the sound and its several bays, is, however, the usual method, and in the present location of settlements the most available.

Pacific.—Population, 375; assessed value of property, $135,568; area, 1,140. Established by Oregon territorial legislature February 4, 1857. This is the southwestern county of the Territory, bordering on the Columbia river and the Pacific ocean, its great specialty the basin of Shoalwater bay. It is noted for its oysters and fisheries. An extensive establishment for the manufacture of water cement has just been completed by Mr. J. B. Knapp, on the Columbia river, about two miles east of Chenook. The supply of rock is inexhaustible. Preparations are made to supply at least 150 tons per month. About $20,000 have been expended in the buildings and machinery.

The county seat of Pacific county is Oysterville. Other post offices and towns—Willopah, Bruceport, Chenook, and Pacific City.

Pierce.—Population, 860; assessed value of property, $508,806 50; area, 2,000 square miles. Organized by act of the legislative assembly of Oregon

Territory, December 22, 1852. In this county is located the mammoth claim of the Puget Sound Agricultural Company for lands appurtenant to Fort Nisqually, called the Nisqually claim. About a mile east of the city of Steilacoom the United States fort of that name is located. From this point commences the military road to Wallula (the old fort Walla-Walla) via the Nachess pass of the Cascade mountains, opened by the people of Thurston and Pierce counties in the summer of 1853, and an appropriation by Congress of $20,000 expended upon it in 1854, by Lieutenant Richard Arnold, United States army. A general idea of the line of this road will be obtained by consulting the table of distances measured by odometer at the time of construction. The points designated generally indicate camps where the best water and the greatest amount of wood and grazing may be obtained. The first column of figures indicate the distance from point to point, and the second the distance from Steilacoom:

	Miles.	
To Puyallup river	22½	22½
First crossing of White river	9¼	31¾
Last prairie on White river	6¼	38
Second crossing of White river	11⅞	49⅞
Sixth crossing of White river	5⅝	55½
Le Tête	3¾	59¼
First crossing of Green river	1⅞	61⅛
Bare Prairie	2⅝	63¾
Last crossing Green river at western base of mountain	10⅛	73⅞
First prairie on summit of mountain	3⅜	77¼
Last prairie on summit of mountain	2½	79¾
First crossing of Nachess river	5⅛	84⅞
Crossing of Papattsally	10⅜	95¼
Mouth of Bumping	4½	99¾
Last crossing of Nachess river	11¾	111½
Wenass	10	121½
Where road leaves Wenass valley	16	137½
First crossing of Yakima river	4	141½
First water after leaving Yakima river	18¼	159¾
Second water after leaving Yakima river	7¼	167
Brackish Spring	16¾	183¾
Great Bend of the Yakima	18¼	202
Near mouth of Yakima	15¼	217¼
Terminus of route, opposite Wallula	17½	234¾

The road from Fort Vancouver passes through this county, continuing to Fort Bellingham at the extreme north of the Territory, though not travelled beyond Seattle. From Steilacoom to this latter point the mails are carried tri-weekly on this road. The settlements scattered through the county are connected with each other by good roads permeating the county, and communicating also with the farming settlements of Thurston and King counties.

The county seat is Steilacoom. Post offices—Franklin, Nisqually, and Spanaway; the former named being the post-office of the flourishing agricultural settlement in the valley of the Puyallup. Here, also, is an Indian reservation, at which are concentrated most of the tribes of the head of Puget sound.

Skamania.—Population, 270; assessed value of property, $260,365; area, 1,800 square miles; organized by act of legislative assembly, Territory of Washington, March 9, 1854. This is a mountainous section, there being but little available land within its great area immediately bordering on the Columbia river. The width of the county embraces the summit of the Cascade range; in it are the great cascades of the Columbia, the great gorge made by the vast aggregation of the waters of the upper Columbia and its innumerable confluents and tributaries forcing an exit through this great mountain chain. Through this pass, around these rapids and falls, the first railroad west of the Rocky mountains was constructed to avoid these obstructions to steamboat navigation.

Another matter worthy of remembrance connected with this county was the passage by the legislative assembly of this Territory of an act (January 14, 1865) dismembering this county and dividing its territory between Clarke and Klikitat counties. Congress having in the organic act reserved the privilege to disprove territorial legislation, annulled said law of the assembly of the Territory, (June 29, 1866,) and reinstated Skamania county; the only instance in territorial legislation in which Congress has intervened.

County seat is Cascades. By this is meant Lower Cascades; the Upper Cascades is the only other town. Both are the *termini* of the Cascade railroad; both are points of departure for the steamboats of the Oregon Steam Navigation Company plying up or down the Columbia river.

The narrow strip of land over which the railroad passes affords but little room for any other road. There is, however, a military road from Fort Vancouver (called in the act of Congress making the appropriation for its construction, Columbia City barracks) to Fort Dalles. This road affords land communication between the Cascades and the settlements of Clarke county, but travel by the river almost the universal mode of communication.

SNOHOMISH.—Population, 285; assessed value of property, $69,022 86; area, 1,500 square miles; acres under cultivation, 1,200; organized by act of Washington Territory legislature, January 14, 1861. This county is noted for the pine timber which skirts its numerous streams, which are resorted to by logging camps. These camps are transitory and made up entirely of males, and hence the great preponderance of male population. This also accounts for the fact that at different periods such discrepancies arise in attempted estimates of population.

The county seat is Snohomish City; Muckelteo and Tulalip (the latter the site of the Indian reservation) are the other post offices in this county.

STEVENS.—Population, 550; assessed value of property, $200,579; area, 28,000 square miles; acres under cultivation, 2,500. This county embraces over one-third of the area of the Territory, lying upon both sides of the Columbia and between the Cascade mountains and the eastern boundary of the Territory. On the 29th January, 1858, the present county of Stevens and the territory included within the county of Yakima were erected into a county by the legislature of this Territory. No organization being effected under said act the legislature passed a similar law January 27, 1862, constituting the before described territory into Spokane county. On the 20th January, 1863, the territory east of the Columbia was set off and erected into a separate county, and named Stevens county in honor of the late General Isaac I. Stevens, Washington's first and most distinguished governor. January 19, 1864, Stevens and Spokane counties were consolidated and the name of Stevens ascribed to the united territory. To attempt a description of this large and interesting region, would be to renew the notice of the great plain of the Columbia, the Spokane plains, the Grand Coulee, the Colville valley, all of which have been extendedly noticed in the preceding geographic memoir, which is referred to as largely applicable to this county.

The county seat is Pinckney City. There are other settlements and towns at various points, but it alone is a post office.

Roads.—Wagon roads from Walla-Walla to Colville; from White Bluffs to Lake Pen d'Oreille, the Mullan road; a road from the Dalles through the Yakima valley, and on the west side of the Columbia, to Colville, and roads connecting with the passes of the Cascade mountains traverse this region, and are much travelled by miners and parties driving stock into British Columbia and to the Pen d'Oreille and other mining regions.

THURSTON.—Population, 2,045; assessed value of property, $776,622 75; area, 672 square miles; number of acres on which taxes are paid, 82,522; cattle, 2,691; sheep, 7,877; hogs, 696. Established by act of Oregon territorial government, January 12, 1852. County seat, Olympia, the seat of government of the Territory. At Turnwater, in this county, the first American settlement north of the Columbia was made in the fall of 1845.

Post Offices and Towns.—Beaver, Chamber's Prairie, Coal Bank, Miami, Grand Mound, and Turnwater.

Roads.—Olympia being the head of Puget sound, water communication from the northern settlements, Victoria and British Columbia, and the land travel from the Columbia river northward, terminates at this point. Here, then, may be said to start the great thoroughfare of communication between the sound and Columbia river, terminating at Monticello, where steamboat navigation is resumed. There are no less than three routes within this county southward to Skookum Chuck, two thence to the Cowlitz river—one (the military road) continuing down the Cowlitz to Monticello; an excellent wagon road connects with Steilacoom and thence to Seattle. This county is admirably adapted for roads, and the settlements are all accessible by well defined and good roads.

WAHKIAKUM.—Population, 63; assessed value of property, $9,653 33; area, 225 square miles. Established by act of Washington legislature, April 25, 1854. Cathlamette is the county seat, and post office for the whole county. This county borders on the Columbia river just east of Pacific county. The greatest portion is rough and mountainous, confining settlements to the river front. The timber is of an excellent quality and most abundant, but agricultural tracts are few and not extensive.

WALLA-WALLA.—Population, 3,500; assessed value of property, $1,762,816; area, 8,000 square miles; acres of land on which taxes are paid, 21,152; acres in corn, 2,307; acres in wheat, 7,729; acres in oats, 4,045; acres in barley, 1,125; acres in timothy, 568. In 1866 the yield was as follows: Wheat, 500,000 bushels; oats, 250,000 bushels; barley, 200,000 bushels; corn, 150,000 bushels; beans, 170,000 pounds. Six flouring mills, six saw-mills, two planing mills, two distilleries, one foundry, 52 threshing, heading and reaping machines.

The act of assembly of this Territory creating this county passed April 25, 1854. It then included all the territory between the Cascade mountains and the Rocky mountains and the 46th and 49th parallels, excepting thereout a fraction of Skamania and the county of Klikitat. Settlers were scattered through this vast region, but so widely apart that no organization was at the time attempted. The Indian war of 1855–'56 caused many to abandon the region. At its close, Colonel Steptoe issued, to say the least, a most remarkable *order*, dated August 20, 1856, that "no emigrant or other white person, except the Hudson's Bay Company, or persons having ceded rights from the Indians, will be permitted to settle or remain in the county." This emanated from Major General Wool, then commander of the Pacific military department. This decree of expatriation and forbidding of settlement continued till the spring of 1859, when Major Grier, United States dragoons, *consented* that the rich valley of the Walla-Walla might be occupied by American settlers. Its growth and progress dates from that period, and it is now the most populous and wealthy county in the Territory.

The county seat is the city of Walla-Walla, the largest town in Washington Territory. Post offices—Coppei, Mullan's Bridge, Touchet, Wallula, all centres of thriving settlements.

Roads.—Wallula (the old Fort Walla-Walla) was the point where the great emigrant route coming into Oregon struck the Columbia river. It is now the eastern terminus of usual steam navigation on the Columbia, though occasional trips at favorable stages of water are continued as far as White Bluffs. In primeval days the emigrants continued down the river in boats or on a road along the river to the Dalles. In 1853, a road was constructed from this point, or rather from the opposite side of the river, via Yakima valley and Nachess Pass, to Fort Steilacoom, on Puget sound. A good wagon road, travelled daily by coaches, connects it with Walla-Walla City, 30 miles east. During the past year a road (Wastuckna wagon road) connects it with the forks of Mullan's road and the wagon road from Walla-Walla to Colville, insuring direct communication from Wallula to Colville or Fort Benton. This road is in length 58 miles. The distance via Walla-Walla, from Wallula to same point, was 100 miles.

Walla-Walla is a centre from which roads diverge in all directions, connecting the settlements of the county with each other, and affording routes to Fort Benton, on the Missouri, (by Mullan's military road,) to Fort Colville, Lewiston, and Boise, to Lake Pen d'Oreille, and to the rich mining regions of Montana.

WHATCOM.—Population, 244; assessed value of property, $42,522 50; area, 4,300 square miles; organized by act of Washington legislature, March 9, 1854. This is the northernmost of the Puget Sound counties. Within is Bellingham bay, the shores of which are so noted for their extensive and valuable coal mines, which are fully noticed in an article upon the coal fields of the Territory.

County seat, Whatcom; post offices, San Juan, on the disputed island of that name, and Swinamish.

YAKIMA.—Population, 125; assessed value of property, $68,676 28; area, 7,000 square miles; organized under act of assembly of Washington legislature, January 21, 1865. It embraces the Yakima valley proper lying between the Wenachee river and the northern boundary of Klikitat county. This and the neighboring valleys, passing under the general cognomen of the Yakima country, are the best stock raising region in the Territory; fine soil, excellent grass, and mild winters, with occasional very short feeding seasons, never exceeding between one and two months. Several extensive stock ranches are already commenced, and large bands of cattle are owned in this valley. The county seat is on Colonel Thorp's claim on the Yakima, near the mouth of the Atahnam, and not far from the old Catholic mission. Thirty-five miles above, at the foot-hills of the Cascade mountains, is the Kitatash valley, 40 miles in length and 15 in width, well watered by the Yakima and its tributaries, abundantly though not heavily timbered, and of excellent soil. The new road opened the past season from Seattle through the Snoqualmie Pass runs through this valley, joins the Nachess military road at Thorp's, and as one road they continue to Wallula. The road from the Dalles, Oregon, to the Wenachee, Pen d'Oreille, and mines of the upper Columbia, crosses the Yakima river about 25 miles below Thorp's, and passes through the whole breadth of this county.

The post office for the county is the Dalles, Oregon, from which it is separated by the Columbia river, the width of Klikitat county, the Simcoe mountains, and the Yakima river. A county containing 200 inhabitants, with more inducements for immediate settlement than almost any portion of the Territory in consequence of mineral resources, rich agricultural tracts, and salubrious climate, ought to have one post office and one post route.

SECTION II.

MINERAL RESOURCES.

On the north side of the Columbia river from the Dalles the country is broken and hilly to the Klikitat river, which empties into the Columbia above the Dalles. In the Klikitat valley there is considerable farming, and a large amount of grazing land, with small patches of pines and fir. The Cascade range of mountains is well supplied with forests of pine and fir, except the highest peaks, as Mount Adams, St. Helens, and Ranier, which are covered with perpetual snow, and consequently are entirely barren.

Along the foot of the mountains from the Dalles to the Nachess, the whole country is volcanic, with no minerals of value. On the head of the South Fork of Yakima river a conglomerate is found, composed of pebbles and boulders of sandstone and granite, with small masses of quartz. When this has been disintegrated a trace of gold has been found. To the north of the Nachess quartz veins exist, but they are generally small and barren. Gold is rarely, though occasionally found in them. Further north, near lake Chelan, some diggings have been discovered, which, however, did not pay wages.

On the Columbia river, above Priest rapids, a number of the bars paid fair wages for a short time. The gold was very fine, and had evidently been moved a long distance by the action of the water. The eastern slope of the Cascade range in this Territory has been pretty thoroughly prospected for gold. Except in the instances before mentioned, none has been found. There is a large amount of good grazing and farming lands, but no mining. In the northeastern portions of the Territory, about Fort Colville, mines have been worked, though not profitably. In the regions adjacent to the Rocky mountains, doubtless good mines will yet be found.

COAL.—The appearance of veins and outcroppings of coal in almost every section of the Territory west of the Cascade mountains indicates its very general distribution and inexhaustive supply. It is found on the Columbia, as also upon streams emptying directly into the Pacific; it appears at Clallam bay, just within the Straits of Fuca; following round our inland sea, we find it in exhaustless fields back of Seattle, then upon the Sto-lu-aua-mah, and at Bellingham bay, in the extreme north. Its presence at intermediate sections within an area bounded by the above designated points upon the Cowlitz and Skookum Chuck, the Chehalis, and on the Dwamish, Black, and Green rivers attests its thorough and universal diffusing; the continuity of the strata through this whole region.

George Gibbs, favorably known to the scientific world, and highly regarded by his fellow-citizens of his adopted Territory, thus alludes to the universality of coal indications:

> The whole of this formation has been considered by geologists as tertiary, and the coal as not belonging to the true coal. Be this as it may, its value for economical purpose is unquestionable. Even that on the Cowlitz and Skookum Chuck, though inferior to the product of the Dwamish and Bellingham bay mines, was abandoned only from its not being accessible to tide-water.
>
> A singular circumstance in connection with this subject has been noticed at the southern end of Whidby's island. A crevice in the earth exists there, from which smoke constantly ascends, rising undoubtedly from the burning of a bed of coal or lignite beneath. The clay around its edge is said to be baked of a brick red. It has been burning since the settlement of the country, and is popularly called a volcano.
>
> No scientific exploration whatever has been made of this region, nor even such an examination of particular beds as to justify any opinion respecting their value. Such experiments as have been tried indicate that for steaming purposes the quality of the coal is very good, but to what extent the beds can be worked is not settled. They appear on the edge of the water, most of them not above the high tides of winter, and it would seem that they dip slightly in shore, as well as in a direction parallel to it. From the appearance of upturned edges of sandstone between high and low-water mark, it is conjectured that the coal extends beneath the surface of the bay, and that to the north of it it will be perhaps found in place and in the natural position of the strata. The formation commences at the Columbia river, where lignite or brown coal is found in thin seams, and extends continuously northward to a great distance, the quality of the coal improving in that direction.

BELLINGHAM BAY MINES.—These mines are located in the extreme north of the Territory, and have already acquired a wide-spread reputation, not only for their extent, but also for the quality of the coal. In the fall of 1852, Captain William Pattle, then engaged upon a contract to furnish the Hudson's Bay Company with timber from Lopez island, crossed over to the shore of Bellingham bay in search of suitable trees for his purpose; while walking along the beach, he observed several seams of coal. Himself and two parties working with him (Messrs. Morrison and Thomas) each immediately located adjoining claims of 160 acres, fronting upon the bay, under the provisions of the donation law, then in force in this Territory. The northernmost one was taken by Pattle; it is next south of the claim on which the present town of Sehome is erected; the other claims were taken in the order named.

Messrs. Pattle, Morrison & Thomas leased these claims to a San Francisco company, who sent Captain William A. Howard (now of the United States revenue service on duty at Sitka) to the bay as superintendent. A vein was opened on the "Morrison claim," called the "Ma-moosie mine," from which a cargo of 150 tons was taken out, when the enterprise was abandoned. George Gibbs, esq., the geologist of the western branch of the Northern Pacific Railroad Exploration, thus speaks of it, March 1, 1854:

> The seam which had been most worked, that known as the Ma-moosie mine, was altogether eight feet through, but divided by three feet of clay and slate, leaving only an equal amount of workable coal. A drift had been carried in about 175 feet, the quality improving somewhat. About 150 tons only had been got out, which was mostly on board a vessel bound to San Francisco.

The "Pattle claim" has upon it a vein 11 feet thick. No attempts, however, have been made to develop it, except that Captain Pattle himself took out by hand a small quantity of coal. The claim now belongs to Reuben L. Doyle, esq., of Whidby's island. The "Thomas claim" is settled upon by Daniel W. Harris, who has occupied it since its abandonment by Thomas. In it are two seams visible from the beach. No real attempt at work has ever been done upon this claim.

In 1860, Morrison sold his claim to Charles E. Richards, esq., (to whom as assignee the United States government issued patent in 1866.) In 1860, Mr. Richards associated with him several gentlemen under the name of the Union Coal Company. They opened a vein and sunk a shaft about 100 feet. The vein worked was but two feet in thickness, although there was another of eight or nine feet upon the claim. That company took out and shipped to San Francisco an aggregate of about 2,500 tons. This claim has lately been transferred to a company in New York, who propose the present fall to commence a thorough system of operations.

The mine of the Bellingham Bay Company is the mine upon which the reputation of this whole region has heretofore depended. It is situate between the towns of Sehome and Whatcom, on the shore of the bay, about two miles north and east of Pattle's discovery. The vein had been laid bare by the blowing down of a large tree. Claims were at once taken by the discoverers, Messrs. Brown and Hewitt, in the fall of 1853. Late that fall several gentlemen of San Francisco formed the Bellingham Bay Company, and sent Captain W. H. Fauntleroy and Calhoun Benham, esq., to examine the mines. They purchased the two claims for $18,000. Colonel E. C. Fitzhugh, afterwards judge of the supreme court of this Territory, was for several years the superintendent, and up to 1860 the shipment of coal to San Francisco averaged about 500 tons per year. In 1860 the old Bellingham Bay Company leased these mines to Moody and Sinclair, granting to the lessees the privilege of taking out 1,000 tons per month. But the yield exceeded that quantity; their exportation the first year amounted to not less than 15,000 tons, which gradually increased each subsequent year. In 1866 the present management commenced, with Colonel A. Hayward, the modern Crœsus, holding the controling interest. R. E. Myers, esq., is resident superintendent. The delays in the fall of 1866, incident to the change of managers, caused a suspension of active mining operations. By the time matters were satisfactorily adjusted the mine took fire, the extinguishment of which prevented the resumption of mining till June, 1867. Indeed, now (September 1) the lower gallery is not yet completely pumped out. This company own about 3,000 acres of land in compact form, and have expended in improvements not less than $100,000. The shaft is about 500 feet deep, the slope at an angle of 45°, decreasing as you descend; the first gallery 300 feet down, and the one now being worked extends some 600 yards. The lower gallery, which is still being pumped out, (though in it operations will soon be, if they are not already, renewed,) has been worked to the distance of 600 yards. It is in contemplation this fall to widen the slope to admit a double track, enabling the simultaneous descent and ascent of cars into and from the mine. About 100 tons per day are now being taken out, but arrangements are in progress by which the daily yield will be increased to 400 tons. The present cost per ton to put on shipboard is about $3. Practical miners express the opinion that if the claim was worked further from the beach there would be less slate, the coal would be clearer, and the expense per ton could be materially reduced by the cleaning process being rendered unnecessary.

Mr. John Hewston, well known on the Pacific coast as a leading chemist, analyzed this coal in October, 1858. The following is his report:

Specific gravity	1.309	
Water (hygroscopic)		5.60 per cent.
Dry coal		94.40
The dry coal consists of—		
Carbon	74.41	
Hydrogen	4.63	
Oxygen, nitrogen, and sulphur	17.61	
Ashes (red)	3.35	
	100.00	
Amount of coke procured		62.60 per cent.

Subjoined is a copy of the analysis of various samples of Welsh, Newcastle, and Scotch coals, with which it will be seen the analysis of the sample from Bellingham bay compares very favorably:

Locality or name of coal.	Specific gravity.	Carbon.	Hydrogen.	Oxygen, sulphur and nitrogen.	Ashes.	Per cent. of coke left by each coal.
WELCH.						
Aberdare Co's Methyr	1.31	88.28	4.24	4.22	3.16	85.83
Nixon's Methyr	1.31	90.27	4.12	4.36	1.25	79.11
NEWCASTLE COALS.						
Newcastle Hartley	1.29	81.81	5.50	5.55	7.14	64.61
Healey's Hartley	1.31	80.26	5.28	5.34	9.12	72.31
Bates' West Hartley	1.25	80.61	5.26	9.88	4.25	....
West Hartley Main	1.25	81.85	5.29	18.35	2.[illegible]	59.20
Buddles' West Hartley	1.23	80.75	5.04	10.36	3.85	....
Hastings' Hartley	1.25	82.24	5.42	9.40	2.94	55.60
SCOTCH.						
Wallsend Elgin Vein	1.20	76.09	5.22	7.99	10.70	58.45
Dalkeith Coronation Vein	1.31	76.94	5.20	14.75	3.10	53.05
Dalkeith Jewel Vein	1.28	74.55	5.14	15.94	4.37	49.80
BELLINGHAM BAY	1.31	74.41	4.63	17.61	3.35	62.66

The test for the calorific value of this sample of coal shows it to compare very favorably with the same coals, as will be seen by reference to the following table:

Name and locality of coal.	Pounds of water which 1 pound of coal is capable of elevating from 38° to 212° Fahrenheit.	Pounds of water which 1 pound of coal is capable of evaporating from 212° Fahrenheit.
WELCH.		
Aberdare Co's Methyr	77.11	14.37
NEWCASTLE COALS.		
Newcastle Hartley	72.00	13.42
Carr's Hartley	69.83	13.01
Healy's Hartley	68.61	12.78
Steamboat Wallsend	65.08	12.13
SCOTCH.		
Wellwood	64.13	11.94
Eglinton	54.96	10.24
BELLINGHAM BAY	59.90	11.17

STO-LU-AUA-MAH COAL.—This exists in workable seams, but at present seems inaccessible to market. A specimen was sent by Commodore C. W. Skinner, United States navy, to Professor Walter R. Johnson for analysis. That distinguished chemist thus speaks of it:

> It seems to be one of the finest American coals which I have yet seen. It has a specific gravity of 1.315, and will weigh, in the merchantable state, from 51 to 55 pounds per cubic foot, according to size of lumps, and will require on board a steamer about 42½ feet of space to stow one gross ton. It is of brilliant lustre, wholly free from liability to soil. It is composed of—

Volatile matter	40.36
Fixed carbon	56.84
Earthy matter	2.80
	100.00

> After the luminous flame ceases the coke burns with a bright glow, and leaves a light brick red, or salmon-colored ash.
>
> In coking, the coal scarcely increases in bulk, has no tendency to agglutinate, and consequently preserves an open fire, burning freely, and does not cover itself with ashes to such a degree as materially to obstruct the combustion. I suspect the specimen sent to have been taken from near the outcrop of the bed. If so, we may reasonably expect that, when pursued under greater covering, the amount of illuminating gas given out will be greater than was shown by this specimen. The coal seems to be nearly free from sulphur. The ratio of its fixed to its volatile combustible matter is 1.4 to 1, and, under a well-constructed boiler, ought to produce from seven and a half to eight and a half pounds of steam from 212° to one pound of coal burned.

THE SKOOKUM CHUCK COAL FIELDS.—The late Dr. R. H. Bigelow, who was thoroughly conversant with coal, and afterwards opened a mine in the vicinity of Seattle, made an examination of these veins. He thus describes the geological position of the coal:

> Resting upon argillaceous and sandstone shale, overlaid by new red sandstone, averaging (sandstone and earth) 30 to 50 feet thick, interspersed with ochre, red chalk, and a grayish-brown clay—such as is used in Europe for making fire-brick—the average thickness of the coal strata being from four to nine feet. The coal, when ignited, retains a flame of the greatest fervency, leaves no cinder, and is perfectly free from all foreign substances.

CLALLAM BAY MINE, sometimes called the Thorndike mine, after its discoverer, Captain J. K. Thorndike, formerly of Port Ludlow, Washington Territory, is situated on the Straits of Fuca, about midway between Pillar bay and

Clallam bay, 23 miles east of Cape Flattery. Captain Thorndike thus describes his discovery:

> The height of the mountain is from 1,000 to 1,200 feet; the formation is sandstone. Six leads of coal, ranging in thickness from one to three feet, dip 10 degrees, distance between coal leads ranging from 12 to 100 feet. From high-water mark, 30 feet; to low-water mark, 150 feet. From coal leads to five fathoms' water, about 600 feet.

An officer on the United States steamer Massachusetts thus speaks of the character of this coal:

> I find it superior to any coal I have seen on this coast, with one exception—that is its rapidity of combustion. It leaves about five per cent. of clinker, which, with proper tools, can easily be removed from the grates. The weight is 47 pounds per cubic foot, and deposits, including clinker, about 30 per cent. by measure. It compares with Cumberland coal for weight against equal bulk as 8 to 10; evaporative efficiency, 6 to 10.

An analysis of a specimen of this coal by Professors J. H. Alexander and Campbell Morfitt exhibits the following result:

Specific gravity, at 62° Fahrenheit	1.316
Carbon, volatile and fixed	0.69272
Hydrogen	0.06778
Sulphur, volatile ?	0.03402
Oxygen, nitrogen	0.12048
Ash	0.08500
	1.00000

This mine is now being worked under the auspices of a California company, and but recently a cargo of 450 tons was shipped to San Francisco. The great drawback here is the absence of any harbor or good anchorage.*

Seattle Mine.—The extensive coal fields in the immediate vicinity of the flourishing town of Seattle are now commanding great attention. The earliest attempted development was in 1854, upon what is known as the Bigelow mine, on Black river, about 10 miles from Seattle in a direct line. This mine is accessible by light-draught steamers to within several hundred feet. It was recently purchased by S. B. Hinds and Company, an enterprising firm at Seattle, who have commenced active operations towards its development. All work upon it had been suspended for years before the death of its original owners, Dr. R. H. Bigelow. A shaft is being sunk, which will reach the coal at the depth of 70 feet, from the mouth of which, by a chute, the coal can be directly laden into scows or barges. The vein at the croppings is 23 feet thick, mostly clean, pure coal, mixed with dirt on the sides, but to all appearances free from slate or sulphur. No analysis has been made, but smiths who have used it pronounce it superior, for their purposes, to any coal obtainable on this coast, though inferior to the Cumberland. It burns up very clean, leaving nothing but a clear white ash, with no clinkers.

Lake Washington Coal Fields.—These mines, which are now attracting so much interest, are situated from two to three miles east of Lake Washington, and are distant from Seattle in a direct southeast line eight or nine miles. Coal of the same character is also found in the Squak valley, some three or four miles southeast of Lake Washington; in fact, through this whole region, for some miles distant. By some these seams are regarded as continuous. But the country lying between is rugged and mountainous, and it may be found that the basins are separate, though without doubt they were originally the same deposit. The

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* George Davidson, esq., in his Directory of the Pacific Coast, thus describes this bay: "The shore-line is nearly straight, bluff, and bordered by rocks, with an occasional stretch of sandy beach. The bay is at the western termination of a high, bold, wooded ridge, running parallel to the shore, with an almost perpendicular water-face, and falling away rapidly inshore. This easily recognized ridge is about 1,000 feet high and seven miles long. The water along the face of this ridge is very deep, and the bottom rocky and irregular. * * * Off the mine, at the distance of a cable's length, a depth of 35 fathoms is found, with a swell upon the rocks sufficient to destroy any boat loading there."

Rev. George F. Whitworth, a gentleman of scientific culture, whose judgment is entitled to great respect, thus speaks of these mines:

> The coal is found in what I take to be the tertiary formation. It is not as solid as the Cumberland coal, nor is it of the same specific gravity; but it should be borne in mind that all the coal as yet taken out is little better than mere outcroppings. Some of the very first coal taken out, upon being tested, was found of the specific gravity of 1.178, while similar samples from the Nanaino at the time of its opening were 1.04. The later coal, from the deep of the seam where it is now worked, is 1.25. A similar increase may be expected as this coal is more deeply worked. It is remarkably clean, is a jet black, and as we advance along the seam is becoming much harder. Some of it seems to be nearly as hard as anthracite. It burns with a clear flame, does not emit the black smoke so common to other coals on the coast, and so far as tried it is pronounced superior for purposes of steam. Its heating power seems to be very great. It burns up thoroughly, making no clinker, and leaving a very small proportion of ashes.

Competent engineers, employed in the navigation of these waters and in foundries connected with our large mills, speak of this coal as "kindling quickly, burning freely and clean, emitting a strong heat, making little or no clinkers, and leaving about 10 per cent. in ashes." One of them, an old engineer, says: "For steaming I prefer it to any coal I have as yet tried on the Pacific coast."

Two companies have been incorporated for the purpose of working these mines. The first, called the "Coal Creek Road Company," derive their act of incorporation from the legislative assembly, with right of way to build a rail or tram-road from their mine upon Coal creek along its bank to where it empties into Lake Washington, (distance three miles.) The capital stock, in shares of $200 each, may be increased from $5,000 to $500,000. The mine of this company is on a quarter section of land, distant in a direct line from Seattle about eight miles. The Lake Washington Coal Company, incorporated under the general incorporation law of the Territory, own three quarter sections, adjoining the claim of the Coal Creek Company. Capital stock $500,000, divided into shares of $100 each.

Mr. Whitworth's description of the mines of the latter company will give a general idea of all these mines. He says:

> We have four seams of coal, but have only opened two of them at a point where they crop out on the creek, and have only penetrated them on a level from 30 to 50 feet from the entrance. So far as we have gone there is very little lying above where we have worked, hence no great amount of pressure, but with every seam we have a good floor, and covering of sandstone. They all dip at the same angle 38° toward the north, and their general direction is from east to west. The seams we are working would be counted as the second and fourth in the series, the latter being the furthest down the creek, but is the highest in the strata, and consequently the latest in formation. This seam is about seven feet thick, but has from one to two feet of slate or fire-clay, which separates quite freely from the coal in the process of mining, leaving about five feet of pure coal. Seam No. 2 is about 10 feet thick, and has only one or two thin streaks of clay of about half an inch thick, which also separates from the coal in mining, giving over nine feet of pure coal to the seam. The coal in each seam is very similar, but that in No. 2 is deemed the better. The other seams have not been worked, but judging from the outcrop are similar both in size and quality to the other two. I am, however, of the opinion that when we get to work at seam No. 1, which is geologically 500 feet below the others, it will be found really superior to any of them.

The attempt has been made to exhibit the character of coal as it is found in several localities remote from each other. That there is good coal universally diffused, in quantities inexhaustible and generally accessible for transportation, cannot be doubted. Capital and energy are all that are requisite to develop these boundless sources of wealth. Nature has made the Territory the "Pennsylvania" of the Pacific. Possessed of such a resource, there can be no cause for discouragement as to the future prominence, wealth, and importance of the Territory of Washington.

SHIP-BUILDING.—Mr. Joseph Cushman, receiver of public moneys at Olympia, has kindly furnished the following data in reference to the resources of Puget sound:

The time is not far distant when nearly all the ship-building on the Pacific coast will be done on the shores of Puget sound. No other place has the same natural advantages for building either sail or steam vessels. From the Cascade range to the Pacific, comprising about one-half of Washington Territory, the surface is densely covered with the finest forest growth in the world; some of the trees, straight as an arrow, are 400 feet in height, and 14 feet in diameter near the ground. Varieties of the fir predominate, interspersed with spruce, hemlock, tamarack, white cedar, maple, ash, white oak, and on some of the mountain slopes white pine.

The yellow fir *(abier Douglasii)* is a tree peculiar to the north Pacific coast from the 42d parallel to Alaska, and is only found east of the Cascade range north of the boundary of 49°. This is principally the timber used at the saw-mills on the sound, and is both strong and durable; in fact, it is the strongest timber on the coast, both in perpendicular pressure and horizontal strain.* It is durable for ship frames, decks, outside plank, and spars, and will hold fostering better and longer than the common acidulous oak. The abundance of timber, coal, water-power, and iron ore in the vicinity of navigable waters, together with fine harbors, large saw-mills, temperate climate, and natural facilities for manufacturing cordage, all clearly indicate that the Puget sound country will soon occupy a prominent position in ship-building. British Columbia and Vancouver's island can be the only possible rivals on this coast, and their vessels can only freight coastwise in British ports. Their facilities for ship-building may be a good argument for annexation, but not proper to discourse here. On the waters south of Port Townsend, what is generally called Puget sound, probably about 50 sea-going vessels have thus far been built. Some of them are fine steamers. Several schooners are now on the stocks, to be launched this autumn. Some 10 or 12 vessels will be built the next year, including two or three barks for the San Francisco lumber trade. Four or five hundred schooners, averaging 100 tons burden each, will be wanted for the northern cod fisheries; say 30 or 40 ships for the northern whaling fleet, and 30 or 40 more ships for the coal and lumber trade from the sound. Nowhere can these vessels be built so cheaply as where the timber costs a mere nothing, and where all other natural facilities exist. Capital only is wanted, and that will naturally seek its own best interests; skilled labor also will seek its own reward; so that it is hazarding little to predict that ship-building will be one of the great interests of Washington Territory.

PUGET SOUND AND THE NORTHERN FISHERIES.—Prominent among the resources of the Puget sound country is the building of fishing schooners and using them in the northern cod fisheries.

The cod and halibut banks in the north Pacific, both on the Asiatic and American coasts, and also around the intervening islands, are known to be numerous, and fish abundant.

The market for cured fish will increase with the supply. Five hundred schooners, averaging 100 tons burden each, and employing 5,000 men, engaged in the fishing business, with more than ordinary fisherman's luck, would not over supply the Pacific market. San Francisco would, of course, be the wholesale centre of trade and supply for California and other mining countries, the Pacific islands and fleet, Hongkong and other Asiatic ports, and all ports south to Valparaiso. Decayed codfish via the Horn will no longer be a marketable article in San Francisco. The Atlantic cod fleet, American, English, and French, number some 3,000 vessels, manned with about 30,000 men; yet the price of dry and pickled fish has been gradually rising for the last 15 years, and this, too, under the bounty act of Congress and the reciprocity treaty with Great Britain.

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* Experiments made by the French authorities in the imperial dock-yard at Toulon (see Forbes's Vancouver's Island, p. 62, and appendix to same, p. 14) show that masts from Vancouver's island are superior to the best class of Riga spars. The report of the French engineers, which is equally applicable to the masts and spars of Puget sound, says: "The principal quality of these woods is a flexibility and tenacity of fibre rarely met with in trees so aged; they may be bent and twisted several times in contrary directions without breaking," and possess other rare qualities, such as "exceptional dimensions, strength, lightness, absence of knots, &c."

The main eastern cod-fishing fleet lies at anchor in the eternal fogs of the Grand banks, in the track of nearly all vessels running between the eastern States and Europe. Owing to collisions and stormy seas on a rock-bound coast, and various other causes, the eastern fishing business is far more perilous to life than either the whaling or merchant service. It is not so on the waters of the north Pacific. Storms there are unfrequent during the fishing season, from April to September, and the climate is more mild and equable than on the eastern coast 10 degrees further south.

Puget sound has unrivalled advantages for prosecuting the cod and halibut fisheries at the north. No other locality except Vancouver's island has similar advantages, and their fish would be subject to heavy duties in American ports.

With no rivalry from the east or elsewhere; with abundance of fish, unfrequent storms during the fishing season, the best climate to cure fish, safe harbors, salt by the cargo at a comparatively low price, and all the requisite provisions for an outfit, it is scarcely possible to overrate the advantages of this region as the centre of the great fishery of the north Pacific. The sound waters are full of clams and small fish for bait. Good ship timber can be had near the shores for the mere cost of cutting.

Situated only a few days' sail from the best fishing grounds, the sound must become the main depot of business. Fish cannot be properly dried and cured either in Russian America or California; the climate of the former being changeable and too damp, and the latter too hot and dry. There is a large population of Fish Indians* both on the sound and in Russian America, or Alaska, who will make good sailors and fishermen.

Finally, the market is extensive and highly remunerative. What more could be desired for the successful prosecution of the business? Fishermen make good sailors; the cabin of the fishing smack is the school-house of the ocean. The full development of this important branch of industry will be a great benefit to the sound country, to the whole coast, to the shipping interest, and to the government as a great means of offence and defence during a war with any maritime nation.

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* What Mr. Forbes says in reference to the fisheries of Vancouver's island is generally applicable on this coast. The business of fishing forms "an exceptional case as regards Indian labor, for in such an occupation as this the natives will work freely and better than a white man. Salmon, cod, halibut, sturgeon, herring, enlachon, &c., may all be caught in great quantities and prepared for export." (Vancouver's Island, its Resources, &c., by Charles Forbes, esq., M. D., M. R. C. S., p. 62.)

OREGON.

SECTION I.

BOUNDARIES, SUBDIVISIONS, NAVIGABLE RIVERS, AND TOWNS.

In describing the boundary lines of this State, we cannot do better than quote from the recent report of the Commissioner of the General Land Office:

Oregon has California on the south and Washington Territory on the north, extending from the Pacific ocean to Snake river, the latter constituting a part of its eastern boundary. It is 350 miles long from east to west, and 275 wide from north to south, containing 95,274 square miles, or 60,975,360 acres, being about half as large as the State of California.

The Coast mountains and the Sierra Nevada, traversing California, continue northward through Oregon; the latter, after leaving California, are named the Cascades. Near the southern boundary the chain throws off a branch called the Blue mountains, which extends northeastwardly through the State, passing into Washington and Idaho.

The course of the Cascades through the State is generally parallel with the shore of the Pacific, and distant therefrom an average of 110 miles. In California the direction of the Coast mountains and coast valleys is that of general parallelism with the sea-shore; the mountains sometimes approaching close to the shore and then receding miles from it, leaving belts of arable land between them and the ocean In Oregon the Coast range consists of a series of high lands running at right angles with the shore, with valleys and rivers between the numerous spurs having the same general direction as the highlands.

In reference to climate and agricultural capacities, Oregon may be divided into two distinct parts, the eastern and western, lying respectively on the east and west sides of the Cascades.

Western Oregon, the portion of the State first settled, and containing the great preponderance of its present population, is 275 miles in length, with an average width of 110, being nearly one-third of the whole State, and contains about 31,000 square miles, or nearly 20,000,000 acres, all of which is valuable for agriculture, for grazing, or for timber-growing, excepting the crests of some of the highest mountains. It is more than four times as large as Massachusetts, nearly three times as large as Maryland, and is greater in extent than the United areas of Maryland, New Jersey, Massachusetts, and Rhode Island.

SUBDIVISIONS.—Oregon is divided into 22 counties. The general characteristics, boundary lines, population, &c., of each county, are thus given in McCormick's Directory:

BAKER COUNTY is situated east of the Cascade mountains, embracing within its boundaries large tracts of excellent agricultural land, together with numerous valuable mining claims which are annually being developed. County seat, Auburn.

BENTON COUNTY contains an area of about 1,556 square miles, and is bounded on the north by Polk county, on the south by Lane, on the east by the Willamette river, and on the west by the Pacific ocean. Number of legal voters, 950. County seat, Corvallis.

COLUMBIA COUNTY is bounded on the north and east by the Columbia river, on the south by Washington and Multnomah counties, and on the west by Clatsop county. According to the late census, it contains a population of 449, viz: males, 297; females, 152. Number of voters, 173. Acres of land under cultivation, 745. The total value of assessable property in the county is $159,970. County seat, St. Helens.

CLACKAMAS COUNTY is bounded on the north by Multnomah, on the east by the Cascade mountains, on the south by Marion and on the west by Washington and Multnomah. Population, 4,144. County seat, Oregon City.

The establishment of a woollen factory and a paper mill at Oregon City has proved beneficial to its progress. Number of legal voters in the county, 1,242. Number of males, 2,448; females, 1,696. Acres of land under cultivation, 6,092. Value of assessable property, $1,605,594.

CLATSOP COUNTY contains a population of 689, viz: males, 388; females, 301. Voters, 179. Acres of land under cultivation, 760. Value of assessable property, $280,000. County seat, Astoria.

CURRY COUNTY is situated in the extreme southwestern portion of the State, and contains a population of 389, viz: males, 224; females, 165. Number of voters, 105. Number of acres of land under cultivation, 400. Value of assessable property, $100,600. Large quantities of good land, suitable for cultivation, remain unoccupied in this county. A new mining district has recently been opened near the mouth of Rogue river, where hundreds of men can find employment during eight months of the year. County seat, Ellensburg.

COOS COUNTY is situate in the southern portion of the State, on the coast, between Douglas and Curry counties. The population, according to the late census, is 1,024, viz: males, 637: females, 387. Number of voters, 313. Acres of land under cultivation, 950. Value of assessable property in the county, $200,000. County seat, Empire City.

DOUGLAS COUNTY contains a population of about 4,000, viz: males, 2,250; females, 1,750. Number of voters, 1,139. Number of acres of land under cultivation, 21,404. Value of assessable property, $1,331,208. County seat, Roseburg.

GRANT COUNTY contains a population of 2,250, viz: males, 2,000; females, 250. Number of voters, 1,300. Acres of land under cultivation, 5,000. Value of assessable property, $295,000. County seat, Canyon City.

JACKSON COUNTY is situate in the southern portion of the State, and contains within its boundaries rich gold mines, which give employment to a large number of its citizens. The population of the county is 2,955, viz: males, 1,755; females, 1,200. Number of voters, 1,253. Acres of land under cultivation, 13,901. Value of assessable property, $1,298,465. County seat, Jacksonville.

JOSEPHINE COUNTY is situate in the southern portion of Oregon, between Jackson and Curry counties, and contains a population of about 2,000. The assessable property in the county is estimated at $300,000. County seat, Kerbyville.

LANE COUNTY is situate in the central portion of the State, extending from the Pacific ocean to the Cascade range. The population of this county is 5,527, viz: males, 3,077; females, 2,450. Number of legal voters, 1,318. Acres of land under cultivation, 30,683. Value of assessable property, $3,000,000. County seat, Eugene City.

LINN COUNTY is situate north of Lane, and contains a population of 7,709, being an increase of 937 since 1866. In 1850 the population of this county was only 994. Linn county contains an area of 877 square miles, or 561,200 acres. Number of males in the county, 4,235; females, 3,474. Voters, 2,250. Acres of land under cultivation, 49,405. Value of assessable property, $2,500,000. During 1865 a splendid brick court-house was erected at Albany, the county seat, at a cost of $31,000. The post offices in this county are Albany, Peoria, Lebanon, Scio, Brownsville, Pine, and Harrisburg.

MARION COUNTY contains a population of about 9,000. County seat, Salem.

MULTNOMAH COUNTY is situate on the banks of the Willamette river, in the northern portion of the State, and is the wealthiest county in Oregon. It contains a population of 7,000, viz: males, 4,020; females, 2,980. Number of voters, 1,723. Males under 21, 1,540. Acres of land under cultivation, 4,051. The total value of assessable property is $4,517,291. Since 1865 the population has increased 1,086. Portland, the county seat, is the principal city in the State. During the past year a new court-house has been erected at a cost of $100,000. Numerous brick buildings and dwelling-houses have also been constructed, and the city wears an aspect of general prosperity.

POLK COUNTY contains a population of 4,993, viz: males, 2,788; females, 2,205. Number of voters, 1,125. Acres of land under cultivation, 90,127. Value of assessable property in the county, $1,033,179. County seat, Dallas.

TILIAMOOK COUNTY contains a population of about 300.

UNION COUNTY is situate east of the Cascade range of mountains, and contains a population of about 2,000. Number of voters, 705. County seat, Le Grande.

UMATILLA COUNTY contains a population of 1,805, viz: males, 1,049: females, 756. Number of voters, 797. Acres of land under cultivation, 5,770. Value of assessable property, $887,148.

WASCO COUNTY contains a population of 1,898, viz: males, 1,092: females, 806. Number of voters, 604. Value of assessable property, $1,771,420. County seat, Dalles.

WASHINGTON COUNTY contains a population of 3,491, viz: males, 1,903; females, 1,578. Number of voters, 824, being an increase of 120 since 1865. Acres of land under cultivation, 14,224. County seat, Hillsboro'.

YAMHILL COUNTY contains a population of 4,018, viz: males, 2,200; females, 1,818. Number of voters, 1,082. Acres of land under cultivation, 26,343. Value of assessable property, $1,000,000. County seat, Lafayette.

Census of Oregon in 1865.

Counties.	Number of legal voters.	Males 21 and upward.	Males under 21 and over 10.	Males under 10.	Females 18 and upward.	Females under 18 and over 10.	Females under 10.	Total population.
Benton	739	744	682	599	525	270	533	3,353
Baker	413	419	60	105	126	37	110	857
Clackamas	903	898	507	701	719	360	617	3,802
Columbia	132	136	55	65	78	46	48	428
Clatsop	197	218	71	99	143	57	101	689
Curry	114	117	20	58	45	20	46	306
Coos	197	225	28	85	97	30	86	551
Douglas	939	947	419	719	614	329	681	3,706
Grant	1,402	1,592	101	137	202	54	107	2,193
Jackson	976	979	261	515	512	196	492	2,955
Josephine	328	349	44	118	127	35	119	792
Linn	1,867	1,885	900	1,450	1,370	741	1,363	7,709
Lane	1,318	1,322	645	1,110	899	489	1,062	5,527
Marion	2,004	2,040	932	1,536	1,612	791	1,460	8,371
Multnomah	1,723	1,866	453	1,087	1,464	497	1,019	6,386
Polk	944	957	490	841	731	397	677	4,093
Tillamook	64	64	18	36	37	22	34	211
Umatilla	660	749	158	142	326	99	331	1,805
Union	791	841	205	350	336	240	362	2,334
Wasco	604	613	135	344	369	109	328	1,898
Washington	704	735	350	613	588	307	513	3,106
Yamhill	978	998	442	706	778	323	771	4,018
Total	17,997	18,694	6,976	11,416	11,695	5,449	10,860	*65,690

*Estimated population January, 1868, 78,000.

NAVIGABLE RIVERS.*—The Columbia, Willamette, Snake river, and Pen d'Oreille or Clark's Fork are the four principal navigable rivers, to which may be added the names of rivers navigated for short distances during the season of high water, as follows: Cowlitz river, emptying into the Columbia; Yamhill, Tualitin, and Santiam, emptying into the Willamette; and Clearwater, emptying into the Snake river. All these rivers have been, and are now being, successfully navigated by steamers.

The Columbia is the principal river, and is obstructed at different points by falls and rapids of such a character as to prevent its continued navigation. This great river is divided into four navigable sections. The first is from its mouth to the Cascades, a distance of 160 miles. As far up as the mouth of the Willamette it is a broad, deep river, navigable at all seasons by the largest vessels that cross the bar at its mouth. The obstruction to navigation at the Cascades is of such a character as to make a portage of six miles necessary. This portage is now made by means of a railroad stocked with excellent locomotives and cars. The second section of the Columbia is from Cascades to Dalles, a distance of 50 miles, through the Cascade range of mountains. Here is another obstruction to navigation, known as the Great Dalles of the Columbia. This makes a second portage necessary, and is at present accomplished by means of 14 miles of railway, equal in character to the road at the Cascades. The third section of the Columbia reaches from the Dalles (or Celilo) to Priest's rapids, a distance of 185 miles. From Priest's rapids to Fort Colville, a distance of about 100 miles, the river is so frequently obstructed with rapids that the navigation has never been attempted. Beyond Fort Colville, for a distance of 250 miles into British Columbia, this great river is navigable, and is now being navigated by an American steamer of about 100 tons capacity.

Snake river empties into the Columbia about 12 miles north of old Fort Walla-

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* I am indebted to Mr. J. C. Ainsworth, president of the Oregon Steam Navigation Company, for the data furnished on this subject. It was prepared by Mr. Ainsworth in answer to questions in writing submitted by me during a visit to Portland in August, 1867.—J. R. B.

Walla, and is navigable as high up as Lewiston, in Idaho, a distance of 160 miles. From this point, in ascending Snake river, you go almost due south, and for an additional distance of 150 miles little or nothing is known of the river, except that it passes through a chain of high mountains, and is so obstructed with rapids and falls as to make navigation impossible; but from above this chain of mountains, continuing in a southerly direction, the river is navigable a distance of 150 miles. A fine steamer of 200 tons capacity is now on this section of the river, and has succeeded in reaching a point within 30 miles of the Great Salmon Falls. By the use of this boat and the navigation of Salt Lake (which is said to be practicable) the land travel from Great Salt Lake City to Portland in Oregon would be reduced to about 400 miles.

Pen d'Oreille river, or Clark's Fork of the Columbia, is navigable from foot of Pen d'Oreille lake to mouth of Jako, a distance of about 225 miles. Three fine steamers are now running from foot of the lake to Thompson's Falls, a distance of about 150 miles. Two short portages, of less than seven miles in all, are made to connect these boats. One more boat, above Thompson's Falls, will enable the traveller to reach a point within 125 miles of Fort Benton, on the Missouri.

The distance from the main Columbia to Pen d'Oreille lake is 160 miles, over a good wagon road. Thus the navigable waters of the Columbia and Missouri rivers are only separated by 360 miles of land travel, which can be reduced, by adding a fourth boat on Clark's Fork, to 285 miles.

The Willamette river is navigable from its mouth to Eugene city, a distance of about 200 miles. The only obstruction to the navigation of this river is a forty-foot fall at Oregon City, making a portage of one mile necessary.

There are, in all, some 30 river steamers navigating the waters above named, with an average carrying capacity of about 125 tons each, and employed as follows, to wit: semi-weekly from Portland to Astoria; tri-weekly from Portland to Monticello; daily from Portland to Dalles; tri-weekly from Dalles to Wallula; semi-weekly from Wallula to Lewiston; once a week from Fort Colville to La Porte, in British Columbia; daily from foot of Pen d'Oreille lake to Cabinett, on Clark's Fork; once a week from Cabinett to Thompson's Falls; daily from Portland to Fort Vancouver; daily from Portland to Oregon City; semi-weekly from Oregon City to Corvallis; once a week from Oregon City to Eugene; tri-weekly from Oregon City to Yamhill river. In addition to these regular routes there are several small steamers and propellers that run as business offers.

The amount of freight and number of passengers carried on the different routes named is very difficult to ascertain, but from the secretary of the Oregon Steam Navigation Company I have obtained a statement of freight and passengers transported on the Columbia river from 1861 to 1864, inclusive:

	No. of passengers.	Tons of freight.
1861	10,500	6,290
1862	24,500	14,550
1863	22,000	17,646
1864	36,000	21,834

The freight thus shipped was all up freight, and intended as supplies for military posts east of the Cascades and the different mining camps of Idaho, Washington, and eastern Oregon. As late as 1860 the principal business on the Columbia river was the transportation of troops and supplies for the then Indian country east of the Cascades.

The mineral developments made at a subsequent date in that vast section of country, extending from latitude 42° to 56° north, and from the Cascade range to the Bitter Root and Rocky mountains, have been the means of inducing permanent settlements in several of the rich agricultural districts that lie in different parts of this country; the result of which is that the military are now supplied with grain, flour, bacon, &c., at a less cost than was formerly paid for transportation alone, and the miner is supplied at rates that encourage him to prospect the country and thus develop its treasures.

During the last two years the down freight on the Columbia has largely increased. During the month of June of the present year Walla-Walla valley alone shipped over 500 tons of flour for San Francisco and New York markets, retaining a surplus estimated at 20,000 barrels. To this must be added the new crop now being harvested, and variously estimated at from 200,000 to 300,000 bushels. Grande Ronde valley, situated at the foot of the Blue mountains on the east, has a large surplus—perhaps as much as Walla-Walla. Powder river and Boise valleys are producing large supplies. There are many other valleys in this section, rich in agricultural wealth, that only await the enterprising emigrant, to offer him a luxuriant and happy home.

The banks of the Columbia river, from its mouth as far up as the Dalles, are thickly wooded, principally with fir, oak, cottonwood, and pine, and maple and ash are not uncommon and can be had in limited quantities. From Dalles to Priest's rapids, and from the mouth of Snake river to Lewiston, the banks and adjacent country are entirely destitute of timber. The vast and sparsely populated country through which these rivers flow, east of the Cascade range, is covered with a luxuriant "bunch grass." Stock raisers are appropriating a portion of this immense pasture, and are yearly accumulating fortunes by raising cattle and sheep, for which they find a ready and profitable market in the different mining camps of Idaho, Montana, Washington, eastern Oregon, and British Columbia.

From the 1st of March to the 15th of July, of this year, there were shipped on steamboats from Portland to Dalles 12,191 head of cattle and horses, 6,283 head of sheep, and 1,594 head of hogs. There has doubtless been an equal number driven across the Cascade mountains during the months of July and August, all intended for feeding, accumulating, and marketing as indicated.

The whole country may be said to be mineral. Gold in paying quantities is annually taken from the banks of the Columbia river as low down as Umatilla. On Snake river the banks for miles below Lewiston are profitably worked by Chinamen. This extensive mineral section, embraced within the limits before-named, though adding considerable amounts annually to the treasure of the world, has scarcely been prospected. The work done to develop the mineral wealth amounts to little more than surface explorations.

The Pen d'Oreille river runs through a magnificent grazing, agricultural, and timbered country, almost entirely uninhabited.

The Willamette river drains the beautiful valley of that name. This valley is about 200 miles long and from 20 to 30 miles wide, and sustains a population of about 60,000, with ample room and resources for a million. It is rich in grain-growing and grazing lands, and contains extensive deposits of iron ore.* Coal and copper are also found, but as yet little developed.

PORTLAND.—The principal town on the Willamette river is Portland, situate on the west bank about 12 miles from its mouth. The location is excellent, and the city presents an appearance of thrift and prosperity indicative of the steady progress of the State. Many of the public buildings would be creditable to the best cities of the east of equal population. The new court-house, completed in 1866, the buildings of the Oregon Steam Navigation Company, and other public and private edifices, are among the neatest and most substantial specimens of architecture on the Pacific slope.

Population.—Another evidence of the prosperity of Portland, says Mr. McCormick in his valuable directory, may be found in the annually increasing population of the city, which has increased in a ratio almost equal to any city in the Union. In 1863 the population of Portland was 4,057. In 1864 it amounted to 5,819; in 1865 it was estimated at 6,068. In 1866 it increased to 6,508, according to a census taken especially by canvassers for this work. The following table shows the population according to the several classifications:

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* See article on miscellaneous minerals of Pacific coast.

Males 21 years and upwards	2,017
Males under 21 years	1,104
Females 21 years and upwards	1,330
Females under 21 years	1,108
Colored, males	82
Colored, females	43
Chinese, males	208
Chinese, females	116
Floating population, estimated from hotel registers, &c., &c	500
Total	6,508

Being an increase of 440 inhabitants during the year just closed. These figures do not exhibit a very rapid growth, but they denote a steady progress, which must prove not only interesting but even satisfactory to the well-wishers of Portland.

The present population of Portland is estimated at 8,000, and a rapid increase is expected during the ensuing year, owing to the reduced rates of passage from the east, and the recent gratifying progress in the development of the iron, coal, and agricultural interests of the State.

Assessable property.—Mr. McCormick says:

> The assessable property in Portland is valued at $4,200,000. Taxes levied and collected during 1866, $400,000. Of this amount $91,000 was collected for State, county, school, and road purposes; $150,000 was collected by the officers of the United States for federal purposes, and $159,000 (including licenses and fines) was collected by the city of Portland. Of this amount $75,000 was expended for street improvements, and $84,000 for general and special purposes. The salaries and fees of city officers during 1866 amounted to $15,000. The expense of city surveys, $3.700. The cost of boarding city prisoners, $950. Salary of the city attorney, $1,000. Expense of the recorder's court and city police, $6,000. The amount expended in the improvement of the Willamette river last year exceeded $30,000. Of this amount $20,000 was raised by loan, and $10,862 obtained by special tax. The expense of lighting the city with gas was $3,000, and for furnishing the engine house and city offices with water, $600. The city printing during the year just closed cost $700. From the foregoing figures a crude idea may be gathered of the approximate expenses of the several departments of the municipal government of Portland.

Summary of produce shipped from Portland during 1866.

Pork, 72 barrels, at $20 per barrel	$1,440
Apples, 68,860 boxes, at $1 per box	68,860
Eggs, 1,763 packages, at $10 per package	17,630
Bacon, 4,376 gunnies, at $16 per gunny	70,016
Hides, 4,674, at $1 50 per hide	7,011
Onions, 1,325 sacks, at $4 per sack	5,300
Sirup, 185 barrels, at $8 per barrel	1,480
Wool, 1,671 bales, at $40 per bale	66,840
Pitch, 292 barrels, at $6 per barrel	1,752
Varnish, 124 packages, at $10 per package	1,240
Dried apples, 2,603 packages, at $10 per package	26,030
Flour, 29,815 barrels, at $5 per barrel	149,075
Salmon, 2,564 packages, at $8 50 per package	21,794
Staves and headings, 59,203, average	15,000
Shooks, 14,972, at 40 cents per shook	1,989
Value of specified merchandise, produce, &c	455,457
Value of gold dust, bars, &c	8,070,600

The foregoing tables, although necessarily very incomplete, exhibit the gratifying fact that the export trade of Portland is greatly on the increase, the above amount being $1,120,533 in excess of 1865.

The next place of interest, ascending the Willamette, is Oswego, eight miles from Portland. Here is located the first iron furnace on the Pacific coast.

Four miles above this place is Oregon City, situated on the east bank, just below the Great falls. This is a thriving little place of 1,200 inhabitants. Woollen and paper factories are the chief features of the place. Salem is about 65 miles by water from Oregon City, and is the capital of the State. It contains a population estimated at 4,000. Thirty-five miles further up is Albany, a prosperous town and known as the granary of Oregon; estimated population, 2,500. The next place of importance is Corvallis, a flourishing little city of about 3,000 inhabitants, distant from Albany 15 miles. Eugene City, 71 miles from Corvallis, is the next place of importance, and is located at the head of navigation on the Willamette river; population estimated at 2,000. There are many small towns and neighborhood landings situated at different points between the places named, all or most of which present evidences of thrift.

The principal towns on the Columbia river are, first, Astoria, about 18 miles from the bar; population estimated at 1,000. Next is Cathlamette, 30 miles; then Oak Point, 12 miles; then Rainier, 15 miles; then St. Helens, 20 miles; then Vancouver, 24 miles; then Cascades, 45 miles. All of these places, except Astoria and Vancouver, are small villages or landings. At Cascades is the first portage on the Columbia. On the north side of the river, as before stated, is an iron railroad six miles long; on the south side is a wooden trainway of six miles, over which passed all the freight of the upper Columbia prior to April, 1863, at which time the iron road was completed. The next town of any importance is the Dalles, 50 miles further up. This is a busy little place, containing a population of about 2,500. Here another iron railroad of 14 miles connects with the upper boats at Celilo. Eighty-five miles further up is Umatilla, the great landing-place for Idaho and eastern Oregon; its population is about 1,500. Thirty-five miles further up is Wallula, or old Fort Walla-Walla. This is the landing for Walla-Walla and Grande Ronde valleys, and during the season of low water is the landing for goods shipped to Montana via Pen d'Oreille lake, and for Fort Colville and British Columbia. This place, though one of the oldest, has only a population of about 200. The next and only place of any note above Wallula is Lewiston, in Idaho, distant about 160 miles. This place has a population of about 1,000, is the head of navigation on Snake river west of the mountains, and was formerly the seat of government of Idaho Territory.

SECTION II.

AGRICULTURAL AND MISCELLANEOUS RESOURCES.

Oregon is peculiarly an agricultural and fruit-growing State, though by no means deficient in valuable mineral resources. Possessing a climate of unrivalled salubrity, abounding in vast tracts of rich arable lands, heavily timbered throughout its mountain ranges, watered by innumerable springs and streams, and subject to none of the drawbacks arising from the chilling winds and seasons of aridity which prevail further south, it is justly considered the most favored region on the Pacific slope as a home for an agricultural, fruit-growing, and manufacturing population. As yet it is but thinly settled, a fact owing in part to the injudicious system pursued under the donation act of 1852, by which large tracts of land (320 acres to single settlers, 640 to married couples) were held by persons who were unable to cultivate them; and in part to the insufficiency of communication with the markets of the world. These drawbacks, however, will soon be remedied by the establishment of railroads, the increase of steam navigation, and the consequent accession of population. The wonderful richness of the valleys, the extraordinary inducements to settlement by families, the beauty of the scenery and healthfulness of the climate, must soon attract large immigration. The writer has traversed this State from the Columbia river to the southern boundary, and can safely assert that there is no equal extent of country on the Pacific slope abounding in such a variety of attractions to those who seek pleasant homes. The Willamette, the Umpqua, Rogue River, and many others, are regions unrivalled for farming and stock-raising.

The following extracts from a premium essay written by Mr. W. Lair Hill for the State Agricultural Society give a correct idea of the general resources and productions of Oregon. The descriptions of the country and facts stated are entirely reliable:

> Oregon is peculiar in climate, especially that portion lying west of the Cascade mountains, which is affected greatly by its proximity to the ocean. This portion has a climate in many respects closely resembling that of England. Although in a high latitude, it is mild—neither very hot in summer nor extremely cold in winter; is damp and somewhat disagreeable during what is termed the rainy season, corresponding with the winter of the east; but delightful through the summer and autumn.
>
> The climate in the eastern portion of the State has some resemblance to that of the older northwestern States, excepting the frequent rains which fall in those States during the late summer months.
>
> As a whole, the State of Oregon presents so great a variety of climate that it cannot be accurately exhibited under any general description, and which will more fully appear from special descriptions and tables hereafter presented. It is a matter to be regretted that the compass of a brief essay does not permit the presentation of minute and extensive details of observations on this, as well as many other subjects connected with this infant State, so far as the same are obtainable; but it is much more to be regretted that no record has been kept from which statistical information might be collected, showing the industrial and commercial capabilities of the State, except to a very limited extent.
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> Oregon was admitted into the Union in February, 1859, and in 1861 began to give additional promise of future prosperity by the discovery of rich and extensive gold mines on its northeastern border and the contiguous districts of Washington Territory.
>
> PHYSICAL GEOGRAPHY, &c.—All the country in North America lying west of the Mississippi river has a common axis of elevation, which is the great chain of the Rocky mountains, and their southern continuation, the Cordilleras of Mexico. The Sierra Nevada range, with its northern extension, the Cascade mountains of Oregon and Washington Territory, constitutes a secondary axis which materially affects the entire country of the Pacific coast, both in soil and climate. To the volcanic forces of these two great central lines of subterraneous commotion is originally due the physical geography of Oregon.
>
> It is generally known that the Rocky mountain range is chiefly of igneous composition. Some portions of this range are of plutonic character, while some bear unmistakable evidences that their upheaval was prior to the process of consolidation. Sandstone abounds in many places in these mountains, and very considerable silurian deposits are also found. Gold-bearing rocks occur in various localities. Where sedimentary rocks are found they are frequently regular in their stratification; generally, indeed, distorted from their original position, but nevertheless retaining perfectly their stratified character. These rocks are usually interlaid with micaceous slate, and rest on masses of granite and gneiss. Mica is so abundant in some places that it may be found in extremely thin flakes in all the water of the mountain streams.
>
> Of the same general character is the geological structure of the Cascade range, except that there is less of stratified rocks, and stronger indications of recent volcanic action are observed. Basaltic and granitic rocks constitute the geological basis of the country. Slate and other argillaceous rocks, and a sort of irreducable limestone, also characterize the western slope of the continent. Metamorphic features become more marked the nearer we approach the Pacific coast, until, arriving at the Cascade range, this characteristic is seen in its most clear and unmistakable aspects.
>
> Certain differences between the soil and vegetation on the east and those on the west side of this second volcanio axis of the country may, it is thought, be satisfactorily explained by atmospheric or meteorological peculiarities; so that the upheaval of this ridge, notwithstanding those differences, was probably contemporaneous with that of the Rocky mountains, or at least at no earlier period. Whether this be so or not, it is certain that the Cascade range has undergone much more recent convulsions; and, indeed, of the numerous vents standing along the summit line, some might be properly classed, at present, as active volcanoes.
>
> Between the Cascade and Rocky mountain chains, the country is composed of immense plateaux, interspersed with numerous unconnected mountain ridges, of recent volcanic origin. Some of these are covered with immense forests, while others are merely sterile masses of

trappean rocks, piled together in rugged heaps by the elevatory force of internal fires. By some of these less noted elevations and by spurs projecting from the two main ranges, the broad table lands above mentioned are divided into three distinct valleys, or rather basins; namely:

The Utah basin, centring at Great Salt lake, but having many undulations forming minor geographical centres, to which its rivers flow and disappear in the sandy plains, or discharge their currents into inland lakes. This basin has no outlet to the sea.

The Klamath basin, lying to the northwest of the Utah, and drained by the Klamath river, running to the Pacific ocean, and the river Des Chutes, emptying into the Columbia.

The Columbia River basin extends over a vast area of country, including all that portion of Oregon lying east of the Cascade mountains, and known as eastern Oregon, except the small surface occupied by the Klamath, a part of which is in California, and an almost equally small portion of the Utah basin, which lies principally in Utah Territory.

Eastern Oregon, besides containing several large lakes, is traversed by numerous rivers, but none are navigable except the Columbia and the Snake or Lewis river; which two streams, however, afford facilities for steamboat travel from the ocean, across the whole extent of the State in its greater dimension, from west to east.

That portion of the State lying west of the Cascade mountains is divided into three principal valleys, the Willamette, the Umpqua, and Rogue river, drained by the rivers bearing these respective names. This country is quite different from eastern Oregon in respect to its physical geography, geology, and climate.

Although the general character of this region is indicative of its having had formerly a volcanic origin, still there is found here a large proportion of sedimentary rocks, especially sandstone and a sort of conglomerate of highly silicious composition, which often contains shells and other indications of its sedimentary formation. In the Willamette valley this feature is chiefly observed on the western side of the river; and in the Umpqua and Rogue River valleys it becomes more marked on approaching the sea-coast. Shales and a sort of argillaceous limestone, irreducable by the ordinary process of heating and slaking, also abound in many places. The country here is of a much less mineral character than that east of the Cascade mountains, or even than those mountains themselves. Notwithstanding the evidences of volcanic origin common to all the western coast of America, and of which this region presents many, the rocks here, and especially on the Coast mountains, are often found regularly stratified, and in some instances their parallelism remains undisturbed for considerable distances.

The geological basis of the Coast mountains is sandstone. Scoriaceous and trappean masses occur in the more volcanic localities. At the intersection of these mountains by the Umpqua river, sandstone prevails, and the strata remain uninterrupted, except at long intervals.

Numerous bays and estuaries of different magnitudes intersect the shore along the western border of the State, and several streams having their sources in the Coast mountains flow into the ocean through small valleys of great fertility and beauty.

CLIMATE.—Eastern Oregon possesses a climate much resembling that of the Upper Mississippi valley, but not so cold. It is dry and open; usually somewhat bleak, owing to the large proportion of prairie land, but seldom bitter cold, the mercury rarely falling below zero in the extreme of winter. Last winter, however, it was exceedingly cold in this region; but that was a winter unexampled in severity everywhere in the Pacific States.

Spring in eastern Oregon is fine, early, and open. Summer is hot and generally dry, with cool nights. Variations of temperature, corresponding with differences of altitude, are observed, sometimes amounting to several degrees at places only a few leagues apart. Autumn frosts begin some time in October, but it does not become wintry till very late. Little rain or snow falls except in the mountains. Eastern Oregon is exposed to an almost continuous breeze which sometimes swells into quite a gale, but storms never occur. The wind in summer is from the southwest.

Western Oregon has a moist, mild, and peculiarly uniform climate. Except in rare cases the winter is not cold nor the summer hot more than two or three days in succession, and extreme heat or cold never occurs.

It is rarely necessary to feed stock for more than a fortnight, and frequently not at all during the whole year.

The amount of rain which falls in this part of the State during the rainy season has been greatly exaggerated, as will be seen by reference to the annexed tables, which exhibit more specifically the climatical peculiarities of the State.

Observations taken in several other States are inserted in some of the tables for the purpose of making comparisons. The first table is compiled chiefly from the Smithsonian report; the rest are from various reliable sources.

TABLE I.—*Showing comparative mean temperatures.*

Time.	Astoria, Oregon.	Corvallis, Oregon.	Dalles, eastern Oregon.	Augusta, Illinois.	Hazlewood, Minn.	San Diego, Cal.	Albany, N. Y.	Dubuque, Iowa.
Years of observation	1 1-5	1 1-6	3¼	11½	2	5¼	24	3¾
Spring temperature	51.16	52.19	53.00	51.34	42.33	59.97	47.61	47.36
Summer temperature	61.36	67.13	70.36	72.51	69.95	71.08	70.17	71.42
Autumn temperature	53.55	53.41	52.21	53.28	42.60	64.36	50.01	50.34
Winter temperature	42.43	39.27	35.59	29.80	13.06	52.29	25.83	25.88
Whole time temperature	52.18	53.00	52.79	51.76	41.97	61.93	48.41	48.75

The only point in eastern Oregon whose temperature is exhibited in this table is the Dalles, which, situated as it is, immediately at the base of the Cascade mountains, does not fairly represent the temperature of the extensive valleys further east, which constitute the agricultural region of that country. The summer, in most of those valleys as well as on the table lands, is much warmer than at the Dalles. The winter temperature, it will be observed, is much higher than that of other States in the same latitude, while that of the spring is nearly the same, and the summer not quite so high.

TABLE II.—*Showing the number of rainy days during the winter, at Astoria, Oregon, Willamette valley, Oregon, and Peoria, Illinois, respectively.*

Month.	Astoria, Oregon.			Willam'tte valley, Or.	Peoria, Ill.	
	1857-8	1858-9	1859-60	1846-7	1856-7	1857-8
November	21	16	19	9	9	16
December	25	14	15	13	10	7
January	17	19	19	15	4	6
February	9	20	17	6	10	8
Total	72	69	70	43	33	37

This table includes all rainy days, without reference to whether it rained all day or only a part. It also includes snowy days, very few of which are seen in Oregon in an ordinary winter.

In 1846-'47, Hugh Burns, esq., of the Willamette valley, kept a diary from which it appears there were four days of continuous rain in November, three in December, three in January, and two in February, making only 12 in the four months of the rainy season. During the same time there were 66 entirely clear days, viz: 12 in November, 17 in December, 16 in January, and 21 in February. From the first of November, 1845, to the first of March, 1846, there were 20 rainy and 40 clear days; the rest were variable.

TABLE III.—*Showing the amount in inches, at Astoria, Oregon, and Peoria, Ill., respectively.*

Month.	Astoria, Oregon.			Peoria, Ill.	
	1858	1859	1860	1857	1858
January	8.58	10.82	13.30	.37	1.48
February	4.80	12.62	6.69	5.32	1.95
March	6.83	21.52	5.58	3.84	3.15
April	3.52	2.85	5.69	1.39	6.25
May	2.49	3.17	5.04	2.80	10.64
June	1.38	2.10	1.40	2.77	5.95
July	.44	.48	1.35	1.40	5.85
August	3.40	1.42	.24	5.61	3.24
September	3.91	9.18	2.54	2.16	2.96
October	4.88	5.46	6.96	2.10	3.24
November	8.06	7.77	12.44	1.62	4.85
December	12.44	6.16	....	1.50	....
Total	60.73	82.95	61.23	30.88	49.56

From this table it would appear that the amount of rain at Astoria is a little less than double that at Peoria; the one in a country where the only winter known is a rainy season, and the other in a country distinguished for its cold and dry winters.

SOIL AND EXTENT OF AGRICULTURAL LANDS.—The two natural divisions of Oregon differ in respect to the quality of their soil as well as in climate. The plateaux of eastern Oregon have a moderately rich soil whose chief component is silicia, and containing but a small amount of vegetable matter. Little effort has been made to test its capabilities for agricultural purpose until very recently. The experiment, so far as tried, has proved exceedingly gratifying, and many persons maintain that these uplands are destined to be the first grain lands in the State. But the natural adaptation of these immense tracts is to grazing, cattle herding, and bucalic pursuits. Rolling prairies and level plains of almost illimitable extent stretch out from the foot of the Cascade mountains almost to the eastern border of the State, and are covered with luxuriant bunch grass, (*festuca*,) affording an inexhaustible pasture for any amount of stock. This grows in large tufts not joined together by their fibrous roots, as is the case with most other grasses. It grows to different heights, from six to 18 inches, according to the quality of the soil. In nutritive properties it is not excelled by any grass known. Attaining its full growth about the time the dry season commences, it cures into a fine, flavorous hay, which, owing to the absence of dew in this region in the summer, remains excellent until the autumn rains come, when the whole country is again covered with green grass.

Mountain streams, having their sources in the mountain chains, intersect these table lands flowing through valleys and *rondes* of various dimensions and amazing fertility. The valleys of the Des Chutes and its tributaries are all that have been extensively tested with cereals, and they have yielded very large crops. Vegetables of nearly all varieties yield almost fabulous crops. Indian corn does as well in eastern Oregon as in any State in the Union, and will soon become a staple production. Fruit promises finely. This is thought to be as good a fruit country as that west of the Cascade mountains, so justly denominated the "fruit garden of America."

Its hot summers admirably adapt eastern Oregon to the culture of sorghum or Chinese sugar-cane; and sufficient trial has been made to warrant the assertion that this plant can be produced here as successfully as in any of the northwestern States. Judge Laughlin, of Wasco county, who has paid some attention to the cultivation of this plant, in a published letter of his dated January 12, 1861, says: "I have cultivated some (sorghum) the past two years, and find it grows remarkably well. * * It will produce double as much food as anything (else) I can raise on the same amount of land. * * Mr. Phelps, of this county, has made some very nice sirup, and intends cultivating a crop for that purpose next season."

The cost of making this sirup will not exceed 50 cents per gallon. Its market value cannot be less than one dollar per gallon throughout the country, and two or three times as great in the mines. Planted in April the sugar-cane matures well, and yields a large per cent. of saccharine juice. A farmer, who would give his entire attention to cultivating sorghum and manufacturing sirup in eastern Oregon, could not fail of amassing a large amount of money in a very short space of time. The extent of these valley lands is not definitely known, as no official survey has ever been made of the region in which they lie, excepting comparatively small bodies in the vicinity of the Des Chutes. This stream, the largest affluent of the Columbia in Oregon east of the Cascade mountains, flows through a valley large enough to maintain a population of many thousand persons. It has already some considerable settlements, mostly composed of stock raisers.

John Day river waters a valley much larger than that of the Des Chutes, and of equal fertility. It is unsettled, and offers great inducements to farmers desiring homes near the mines, where market will always be ready, and produce will command high prices. It is about 30 miles east of the Des Chutes and has the same general trend, both running north into the Columbia.

Powder river runs through the largest valley in eastern Oregon, and probably equal to any other in the excellent quality of its soil. Emigrants from the east are fast settling up this valley, and the prospect is that it will soon contain a large population. No settlements were made on Powder river previous to the discovery of the gold mines on its head waters but it is stated that a large number of the emigrants of this season have already selected their future homes there, and expect soon to be surrounded by an industrious and thriving community, and enjoying all the amenities of civilization.

Burnt river has its course through a broken region, very fertile, but better adapted to grazing than to agriculture. This stream is southeast from Powder river, and having the same general direction, flows northeast into Snake river.

East of Burnt river the country is exceedingly uninviting. What valleys there are are small and frequently unproductive. The land, impregnated with alkalies, has scarcely any vegetation growing upon it except artemesia, or sage. Grass is scarce and of poor quality, even along the streams. Of his entering the Burnt river country from this inhospitable waste, in his official explorations, General Frémont says he now came into "a mountainous region where the soil is good, and in which the face of the country is covered with nutritive grasses and dense forests; land embracing many varieties of trees peculiar to the country, and on which the timber exhibits a luxuriance of growth unknown to the eastern part of the continent and to Europe. This mountainous region," he continues, "connects itself in the southward and westward with the elevated country belonging to the Cascade or California range, and forms the eastern limit of the fertile and timbered lands along the desert and mountainous region included within the great (Utah) basin."

The Grande Ronde, lying a few leagues north of the Powder River valley, is a beautiful circular valley some 20 or 30 miles in diameter, watered by a stream bearing the same name. Surrounded by high hills or spurs of the Blue mountains, its amphitheatrical form, relieving its smooth, grassy surface, intersected by a bold stream fringed on either margin with small trees, renders it sufficiently charming, to say nothing of the fertility of its soil, which is unsurpassed. Settlements are being made in this valley, also, by the emigrants who have come over the plains, but it will not all be occupied this season.

The following analysis of the soil in Powder River and Grande Ronde valleys is reported by Frémont:

POWDER RIVER.		GRANDE RONDE.	
Silica	72.30	Silica	70.81
Alumina	6.25	Alumina	10.97
Carbonate of lime	6.86	Lime and magnesia	1.38
Carbonate of magnesia	4.62	Oxide of iron	2.21
Oxide of iron	1.20	Organic matter	8.16
Organic matter	4.50	Phospate of lime	1.38
Water and loss	4.27	Water and loss	5.46
	100.00		100.00

The Klamath basin, it is said, contains a large tract of good agricultural lands, but this may be questionable, as no experiments have yet been made to test its qualities for farming purposes. It is a fine grazing district; even in the midst of December it has been found covered with fresh and luxuriant grass. The Klamath is a magnificent lake, possessing one feature in particular, which lakes do not ordinarily have, viz: *it has no water in it.* It is a fact, though not generally known, that this lake is nothing more than a broad savannah, sometimes covered in places with a thin sheet of water for a brief period, but never entirely inundated, and capable of being easily drained and reduced to cultivation.

Goose lake, Lake Abert, and some others of considerable size, lie in the northern part of the Utah basin, and are said to be surrounded by large tracts of as fine agricultural land as can be found in the State. That there is some good country around these lakes, is certainly true; but enough is not known of this region to warrant a positive statement that they are very extensive.

Rogue River valley, occupying the extreme southern portion of western Oregon, and extending into California is a broken country, or series of valleys, separated by rolling highlands, covered in some places with dense forests of fir and cedar, and in others thinly timbered with oak, and finely set with grass. It is a very good country for farming, and a superior one for stock raising. Rogue river is not navigable on account of its numerous cascades. Like all the western portion of the State, this valley is well watered by numerous mountain streams, which are sufficiently large to afford motive power for running any amount of machinery. It is thinly populated, and would furnish homes for an indefinite number of immigrants. Jacksonville, its principal town, is a place of some importance as a mining town.

The Umpqua valley is a beautiful country, drained by the Umpqua river, a stream of some magnitude, and navigable 25 miles from its mouth for ocean vessels. This fertile valley contains 1,000,000 of acres. It is principally rolling or hilly land, the face of the country in many places forcibly reminding one of the rugged districts of Vermont, or the charming stories he read when but a child of the mountain home of the Swiss.

Numerous tributaries of the Umpqua, some of them quite large, flow through the valley, affording excellent water privileges. Perhaps no country is more conveniently provided with good soil, good timber, and good water than the Umpqua valley. Its population is about 4,500, leaving ample room for 20,000 more, allowing 160 acres to each family of four persons. Roseburg and Winchester, the most important places in this valley, are pleasant villages.

But the most important agricultural district in western Oregon, and probably in the whole State, is the Willamette valley. It is separated from the Umpqua by the Calapooya mountains, a densely timbered belt, having an altitude of about 5,000 feet, and extending from the Cascade to the Coast range. This valley is drained by the Willamette river, flowing north into the Columbia, and which is navigable to the distance of 130 miles from its mouth, direct measure, with only a single obstruction, the falls at Oregon City.

No person can survey the Willamette valley with its alternations of rich meadow-like prairies, undulations, and beautiful streams, without feeling that he beholds the most delightful spot in America. The agricultural country lying along the banks of the Willamette, includes an area nearly equal to that of the entire State of Connecticut, with a combination of advantages inferior to no other section of the United States. Mr. William H. Knight describes this valley as "possessing a soil of unsurpassed fertility, a mild and genial climate, an abundant growth of timber, large natural pastures, where stock may range unsheltered the year round, an excellent commercial position, superior facilities for transportation, and a rapidly increasing population." This is stating the case in rather too strong a light, and requires some qualification in two of its particulars. The population of the Willamette valley has not increased very rapidly for some years past, owing to causes which will become manifest when the subject of commerce is discussed. And the other modification proposed is, that we sometimes have a "cold snap" of two or three weeks duration in the winter, and the last winter still longer, so that stock may not "range unsheltered the year round" every year, and should not be forced to do so any year, as the continuous rains of the winter months are very injurious to all kinds of domestic animals. Aside from this slight inaccuracy, Mr. Knight's description is certainly a very correct one, and the impulse given to the State by the recent discovery of extensive gold fields on the eastern border of the State, cannot fail to make it become speedily true in respect to the increase of population.

This valley is mostly smooth prairie land, large bodies of it undulating, but not hilly, interspersed at intervals, never greater than a few miles, often much less, with streams of various sizes, flowing in across the valley from the mountains on either side. Ranges of low hills, covered with oak timber, are common throughout the valley.

Some of the largest affluents of the Willamette, as the Santiam, Yamhill, and Tualatin, are navigable to considerable distances into the interior; while there is scarcely one which does not afford an ample volume of water to drive any desired amount of machinery for milling and manufacturing purposes.

The Willamette, in common with all this region of the Pacific coast, belongs to the tertiary period. Shells and ligneous petrifactions are numerous, and mammal fossils have been found in various places, indicating a very recent formation.

The soil of western Oregon may be divided into four general classes, viz:

1st. A brown clay loam, of good quality, thinly timbered with oak, producing good grass, and affording fine stock range. It is found chiefly along the spurs of mountains or extended ranges of hills, never in the level prairie.

2d. A dark or black porous soil formed by the admixture of vegetable mold with the clay loam just described. This soil occurs only in the valleys close by or between the mountains, and is unrivalled in productive power. Both of these classes are thirsty, and suffer whenever the summer drought is of very long duration.

3d. A grayish calcareous sandy loam of exceedingly fine quality, covered with a thick turf of grass, and admirally adapted to the cultivation of cereals, especially wheat, oats, and barley. This class embraces five-sixths of the entire valley, including most of the prairie, and much of the oak-timbered land. It is little affected by drought, and though not naturally porous, is pulverized with great facility, and is exceedingly mellow.

4th. A strictly alluvial soil, lying along the immediate banks of the river, and composed of sand, vegetable matter, and various decomposed earths, washed by the current from above. Most of this class of soil is overflowed in extraordinary freshets, which, however, never occur in the growing season of the year, and it is unexcelled in fertility.

Many small and very rich valleys lie along the seacoast, and will doubtless yet become valuable. Among them are the Tillamook, situated on a bay of the same name, the Celets, the Yaquina on Yaquina bay and river, the Coquille on Coquille river. The Coquille and Tillamook already contain settlements of some magnitude.

HARBORS.—There are already opened four ports of entry in this State. The most important harbor is that of the Columbia river, but it is not the only one likely ever to assume much importance. Umpqua river, Port Orford, and the Coquille want nothing but the settlement of the rich districts surrounding them to bring them into consideration as commercial points, while vessels have entered several others and found good harbors. Yaquina bay, first brought to notice only a year ago, is said to be an excellent harbor, extending 30 miles into the coast, and easy of access from the heart of the Willamette valley.

HEALTH.—It would seem invidious to discriminate in favor of any portion of the State of Oregon in respect to its salubrity. Everything that nature could do to render a country perfectly healthful has been done for this State. The mountain air, not less than the mountain water, has a vivifying influence; and the gentle breezes of summer, coming fresh from the sea, are a pleasant and effectual preventive against all the violent diseases ordinarily to be feared in dry and sultry regions.

The climate of Oregon is thought to be unfavorable to the health of persons who are predisposed to pulmonary affections. This is probably true. Notwithstanding this general opinion, however, it is found that fewer persons die here of consumption, in proportion to the population, than in any one of the New England States. And it is certainly beyond question, that in every other respect, there is no other State in the Union worthy to be compared with this for salubrity of climate.

Persons are frequently met with here who had been unable to perform any labor for years before leaving the east, on account of ill health, but have become rugged and strong in this country, and are now regularly engaged in their callings without any physical inconvenience whatever.

MISCELLANEOUS.—Some peculiarities and special adaptation of this State deserve to be more particularly noticed, though space will not allow this to be done at length.

SHEEP.—A very intelligent writer of New England calls Oregon a "mammoth sheep pasture." From what has been exhibited of its soil, climate, and mines, it will be perceived that, with equal propriety and no greater allowance of hyperbole, it might be denominated, also, a mammoth grain field and vegetable garden, and a mammoth gold placer. In a country eminently fitted by nature for so many branches of business as Oregon, discrimination in favor of any one particularly will seem unwarranted, not to say unjust. But certainly if Oregon has a *speciality*, it is her pre-eminence as a wool-growing country Until very recently, little attention has been paid to the matter of sheep raising, but it is now becoming one of the staple interests of the State. Sheep thrive better here than in any other State. Disease among them is exceedingly rare. They increase here faster than in the east, and the wool is of excellent quality. Only one manufactory of woollen goods is yet in active operation. This is located at Salem. Another is in course of construction in Linn county. The wool clip of the State, in 1861, amounted to 444,000 pounds. That in 1862 (estimated by Mr. L. E. Pratt, of the Willamette Woollen Manufacturing Company) is 344,000 pounds. The difference of amount is owing chiefly to the losses of last winter. The average price of wool, in 1861, was 18 cents a pound; in 1862 it is 20 cents. In respect to the quality of Oregon wool, Mr. Pratt says "there is no inferior wool grown in the State." When the eastern papers quote the price of "Oregon burr wool," they mislead dealers to the prejudice of this State, as there are no burrs in the country; they probably refer to wool grown in California, and are imposed upon by dealers of that State.

The Willamette Woollen Manufacturing Company turn out annually 4,000 pairs of blankets, 10,000 yards flannels, 60,000 yards cloths and tweeds, and 4,000 pounds stocking yarn. The cloths are worth, on an average, $1 12½ per yard; the blankets, $8.

The expenses of the factory are $56,000.

LUMBER.—Everything has been done which nature could do to make Oregon to the Pacific what Maine is to the Atlantic coast. The best of timber, with unexampled water privileges convenient of access for sea-going vessels, leaves nothing to be desired in this respect but enterprising men who will engage in the business of supplying foreign markets.

FISHERIES.—All along the sea-coast oyster and salmon fisheries might be made highly profitable. The salmon on this coast are not only more abundant, but acknowledged to be of much better quality than those of the Atlantic. Clam and cod fisheries might also be established along the coast.

BEES.—The introduction of bees into Oregon is of very recent date. They prosper well, and produce a large amount of honey. Three years since a hive was worth $150; now it is worth $25.

FRUIT.—Reference has already been made to this, but something a little more specific is required. For apples and pears Oregon is unrivalled. Cherries thrive passably well. Peaches do not generally succeed well, except some very hardy varieties. Plums are in great abundance, and fairly flavored. Quinces and apricots flourish. Grapes are good, especially early varieties. Shrub fruits generally produce exceedingly well. All in all, Oregon is the fruit garden of America, if not of the world.

PULSE of all kinds, like cereals, yield largely.

COMMERCE.—From the geographical position and internal resources already shown, it does not require that much should be said of its commerce. Certain circumstances, however, have prevented the development of the strength of the State in this respect, the principal of which is the law under which the land of Oregon is held. At an early period of the settlement of the country, a law was passed by Congress donating 640 acres of land to each man having a wife—or rather 320 acres each to the man and wife—and 320 acres each to single men settling in the Territory. The result of this large donation has been to render the population of the State so sparse that all interests of the body social, all the nerves of civilization and progress have been completely paralyzed. This effect has been visible more in connection with the commercial than with any other branch of the social economy of the State, unless it be the educational. It is hoped, however, that these detrimental consequences of the nation's liberality will not longer continue to operate as they have done hitherto; since the largeness of the gift has reduced a great majority of the donees to such a condition as compels them to divide their large tracts of land. When this is done, and not before, Oregon will begin to exhibit that degree of prosperity for which God has given her such ample capabilities.

SCHOOLS.—Oregon though a new country, is not without its school system, and the people of the State manifest an interest in the subject of education which cannot fail of raising the intelligence and refinement of the country to a high standard as soon as the population is sufficient. Common schools are kept in almost every neighborhood, and grade schools and academies are located in several places. Limits of space forbid more specific statements.

CHURCHES.—Also the religious statistics of the State will evidence that the immigrant to Oregon need not fear that he is coming to a barbarous or half-civilized land. While the population of the State is only about 60,000, it contains

Denomination.	*Churches.*	*Members.*
Methodist	33	2,083
Baptist	29	1,073
Congregationalist	10	127
Moravian	,00	700
Reformers, (number large, but not accurately known.)		
Catholic	8	10 000

THE QUESTION.—It may now be asked where and on what terms can land be obtained in Oregon. In the western portion of the State, that is in the Rogue river, Umpqua, and Willamette valleys, the best land is occupied. Farms can be had, however, in these valleys for from $5 to $10 per acre, according to location. There is ample room, and settlement is invited. As good agricultural land as there is in the world can be bought for $8 per acre in any of these districts.

The land in eastern Oregon is, for the most part, vacant. Homes may be obtained by simply occupying them under the provisions of the homestead law, which will take effect on the 1st day of January, 1863, or by the provisions of the pre-emption law. These lands are not yet surveyed, but no difficulty need be apprehended on this account. The immigrant has nothing to do but to comply with the conditions under which he takes, and his title will be secure to a home for his family which even the rapacity of pitiless creditors cannot wrest from them, and which in return for moderate industry will enable him always to have enough and to spare of the good things of this world.

SECTION III.

MINERAL RESOURCES.

The mineral resources of Oregon, though not so thoroughly prospected as those of adjacent States and Territories, are both extensive and valuable, and will no doubt at some future time form a prominent source of wealth.

Placer mining has been carried on extensively and profitably in the southern counties since 1852, and the mines of John Day and Powder river have yielded several millions of dollars since their discovery in 1860. The annual product of these mines, until within the last two years, has been from $1,500,000 to $2,000,000. In common with the surface deposits of elsewhere, there is a gradual diminution as the placers become exhausted. New discoveries, however, are being continually made.

WILLOW CREEK MINES.—A writer in the Oregonian thus describes the mines in the Willow creek country, a region which has attracted considerable attention of late:

> Willow creek is a branch of the Malheur, having its source near the head of John Day's river, and, flowing near 100 miles in an easterly direction, discharges its waters into the Malheur about 15 miles above its junction with Snake river. Although a long stream, Willow creek, owing to the nature of the country through which it flows, much of it being a low mountain or hill country, destitute of timber, receives but few tributaries, and those

few of small size. It is but a small stream in proportion to its length, and its surroundings are gloomy enough and differ but little from those of the Malheur, Owyhee, and other tributaries, on the south side of Snake river, between Farewell Bend and old Fort Hall.

The mines on the tributaries of Willow creek were, I believe, first discovered in 1862, at what is known as Mormon or Humboldt basin, nearly at the same time, by one party from Salt lake and another from the Humboldt mining region in Nevada. This is a small but rich camp, and only lacks plenty of water to render it one of the richest in the upper country. But water it can never have from any outside source, as the basin is higher than the source of any of the streams around it, so that the miners in that locality will have to be content with the scanty supply they now have for three or four months in the year.

But what are known as the Willow creek mines are situated on the south slope of the divide, between the waters of Willow creek and Burnt river, and are now divided into Shasta, Easton, and Willow Creek districts.

Shasta district comprises Shasta creek, Rich creek, Cottonwood creek, Quartz gulch, and many others. Mining has been carried on to some extent on Shasta creek for several years, but it was not until last summer that the district was prospected to any extent, or assumed any importance as a mining camp, or became known as such outside of its immediate vicinity. Since then greatly exaggerated reports have gained circulation in Idaho, Oregon, California, &c.. as to the richness and extent of the mines. In most of the creeks and gulches in Shasta district good prospects have been obtained of rather coarse gold, mostly on the bed rock, which is usually of slate, and generally from 10 to 25 feet below the surface. Shasta, like most of mining districts, contains an embryo town which rejoices in the name of El Dorado City, indifferently supplied with everything but whiskey.

Easton district was organized last summer, and is situate east of and joining Shasta district. It contains a large number of gulches, some of which were worked during last summer, paying very well. Good prospects have been obtained in many others, and if water were plenty it would be a lively camp next season, and continue so for two or three years. In these districts the gold is finer than in Shasta district, and the bed rock (if rock it can be called) is a kind of cement of clay and gravel.

Willow Creek district has recently organized, and comprises the lower part of Mormon Basin creek and a number of gulches east of it, but gold in paying quantities has only been found in one of them. This district is immediately east of Easton district, and the mines are of the same character. These districts are all on the north side of Willow creek, and are comprised in a space of about 12 miles in length and but little over one in width.

Water is very scarce in all the mines in this vicinity. During the spring the melting snow furnishes a good many gulches with water for two or three months. After that is gone, all the natural water in Shasta district would not amount to more than one sluice head in Easton district, including the water in Mormon basin creek, about two, in Willow Creek district about one. And in speaking of creeks in those districts the reader must bear in mind that all the gulches in which water flows during summer (no matter how small the quantity) is called a creek. Most of the gulches are dry during the fall and winter, and a prospector frequently has to carry dirt one-half mile or more to find water to wash it. Another great inconvenience here is the scarcity of timber, it being on the mountains and in cañons remote from the mines. Lumber for mining and building purposes has to be hauled from 8 to 16 miles, and fire-wood from two to five miles, the former costing about $70 per 1,000 feet, and the latter from $12 to $14 per cord.

The climate here is similar to that of the Grande Ronde and Powder River valleys, the amount of snow falling being much less than in the mining regions of Idaho. Yet the winters are very cold. The past two weeks have been about as cold as any weather I ever saw during several years' residence in the mountains. The snow is now about 10 inches deep in the mines, and perhaps two feet deep on the divide between Willow creek and Burnt river.

There is much good agricultural land along Willow creek, Burnt river, and other streams in this vicinity, upon which abundant supplies could be raised for all this part of Oregon, unless the crickets, which seem to be one of the natural productions of the country, should claim too large a percentage of the crop.

Several different ditches have been talked of for bringing water from Willow creek and Burnt river for mining purposes, which would supply Shasta district and subsequently districts east of that, only one of which has been prosecuted to any extent; that being the ditch of Carter, Packwood & Company, which is one of large extent, and will, when completed, supply a large extent of mining ground with water and give employment to many men. But unfortunately there is little probability of its completion in time to do any good next summer; so that many owning claims will have to wait another year before they can work them to any extent, as the mines are of such a nature that they can only be worked by the hydraulic or ground sluice, which requires a large amount of water.

There is a large extent of unprospected country in this part of Oregon, in much of which it is probable gold may be found. Were the facilities better for working the mines, this would soon be a populous portion of the State, but much of the country is destitute of timber and water.

There is but little to induce men to come here at present, but if any do come from Oregon

> and California, they had best not come before the first of May, as before that time the weather will be stormy and unsettled, and they will find it rough camping out in a country where even sage brush for fuel is not very plenty.
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> There are a few stores in the country, at Clark's creek, Mormon Basin, and other camps, but they are poorly furnished with mining tools, clothing, groceries, and in fact everything but whiskey, and other beverages of like nature, which are supposed to be necessary in a country where water is not very plenty. Our nearest post office is at Express, nearly 20 miles. We get our mail matter from there or from Auburn, which is upwards of 35 miles distant. A mail route which would accommodate Clark's Creek, Mormon Basin, and the Willow mines is very necessary, and should receive the attention of our postal authorities.

QUARTZ LODES.—Numerous gold-bearing quartz lodes have been discovered in various parts of the State, but none of them have been developed to any great extent. East of Eugene City, near the McKenzie river, (north branch of the Willamette,) some excellent lodes have been prospected, one of which extends north to Santiam and south across the head branches of the middle fork of the Willamette, Coast Fork, North and South Umpqua, &c. The Blue mountains, in the vicinity of Cañon City, John Day's river, abound in quartz which the miners think will pay, but as there are placer mines in the vicinity, and a lack of capital to erect the necessary mills, they have not yet been worked to any considerable extent. A writer in one of the Oregon papers says:

> The discoveries made in Auburn district, near the western line of Baker county, are known to be rich, but, as is usual, the discoverers are poor and unable to purchase and erect suitable mills for reducing their rock, and, therefore, must be content with simply working out the assessments required by law to hold them. In fact, in no less than five districts in the county, quartz is known to exist in paying quantities, but will not be worked, perhaps, for years to come—until labor is cheaper and the cost of machinery is correspondingly cheaper, and the placer mines are more thoroughly worked. The fact is that wherever placer mines will daily exhibit to the laborer the fruits of his toil, at but little outlay, he is hard to be persuaded to invest time and labor and capital in the business of quartz crushing.
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> Outside of our county, too, there are known to be rich quartz mines, occupying about the same practical position that ours does. The quartz of Elk creek, Granite creek, and Cañon City, in Grant county, together with those of Eagle creek, in Union county, are destined to attract attention before long.

THE IRON INTEREST.—By far the most important mineral resource yet discovered in Oregon is the vast deposit of iron known to exist between the Willamette river above Portland and the Columbia, at St. Helen. Of the entire extent of this valuable deposit there is as yet but little knowledge, but it has been traced for a distance of at least 25 miles, and is beyond doubt inexhaustible. A description of the geological formation in which this iron is found, with some observations on the character of the ore, cost of manufacture, &c., and of iron ores generally on the Pacific coast, will be found in the article on miscellaneous mineral resources.* The following detailed description of the iron works at Oswego is from the Oregonian, a newspaper published at Portland:

> It is cause for sincere rejoicing that the efforts of the enterprising company which has undertaken the development of this most important resource of our State are now almost sure to be rewarded with complete success. It would be difficult to name an interest on this coast which may affect the general prosperity more directly and permanently than the successful working of our iron mines. It is not so much that the proprietors may make money out of them, but it is that some of the chief courses of trade and manufactures will be turned in entirely new channels. These works, if present prospects are hereafter realized, will be able to supply the greater part of the demand of the whole coast for raw iron. This alone is a vast interest; but when we take into consideration that iron-rolling mills and manufacturing establishments of various kinds will surely follow the success of this pioneer effort, the interest which the whole country has in it is immense—entirely beyond the possibility of present conception. In view of this, we shall certainly not be censured if we devote to the various matters connected with these works the greater part of our column to-day.
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> ORGANIZATION OF THE COMPANY.—The "Oregon Iron Company" was incorporated by signing and filing articles in the offices of the county clerk of this county, and of the secretary of State, on the 24th day of February, 1865. The incorporators were H. D. Green, W. S. Ladd, and John Green. The capital stock was fixed at $500,000. The stock was soon taken, the number of stockholders being 20, including many of our most sagacious and

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* Notes on the coal and other miscellaneous mineral productions of Oregon will be found in the same article.

energetic business men. On the 13th of May following, the stockholders held their first meeting, and organized under the provisions of the statute by electing a board of directors, consisting of W. S. Ladd, H. C. Leonard, John Green, T. A. Davis, P. C. Schuyler, H. D. Green, and Henry Failing. At a subsequent meeting of the directors, W. S. Ladd was chosen president; H. C. Leonard, vice-president, and H. D. Green, secretary. Mr. P. C. Schuyler is at present acting secretary.

Cost of the Works.—Thus far the sum of all the assessments levied on the stock is only 27 per cent., all of which has been paid in with the exception of $11,000, delinquent by three of the stockholders. The expenditures for building, opening the mines, constructing machinery, and stocking with material, was, up to the 1st of August, between $124,000 and $125,000. Since that date there have been, of course, some further expenditures, which can, at present, only be estimated; but the total amount is probably within $126,000.

Magnitude of the Works.—The company having prospected the mine, which is about two and half miles from the present village of Oswego, and having had the ore thoroughly tested, began excavating for the walls of the furnace and tower, on the 21st of May, 1865. Since then the work of building and opening the mine has been carried on without more than temporary suspensions till the present day. The works are run by water. taken from Oswego lake. The dam across the creek, just below the foot of the lake, is 148 feet in length, and 22 feet in height, and is a structure of great strength. The flume by which water is conveyed to the works is 900 feet long and 3 feet square. The machinery in the blast-house is driven by one of Leffel's double-turbine water-wheels, which also works a force pump for supplying the tanks with water. The blast-house (where the wind is made) is 38 feet square and 20 feet high. The casting-house is 136 feet long, 58 feet wide, and is a 12-feet story. The stack frame is 34 feet square, and 32 feet high. The top-house is 34 feet square, and 20 feet high. The stack and chimney together are 65 feet in height. The bridge-house is a 12-feet story, 129 feet long, and 25 feet wide; one end resting on the ground on the hill-side, the other supported on heavy truss-work, and connecting with the stack. The first coal-house connecting with the bridge-house is a 12-feet story, 148 feet long, and 38 feet wide. The second coal-house, standing a little apart from the other, is a 24-feet story, 100 feet long, and 40 feet wide. The water tank is 12 feet square, and 8 feet deep. These are the buildings which constitute the works proper; but the company has one or two other buildings in the village, one of which is a storehouse, 50 by 37 feet, and a story and a half high. The stack within, which is the furnace, is a massive pile of masonry, 32 feet square at the base, and 34 feet high. There is probably not a finer or stronger piece of masonry on this coast than this stack. The capacity of the furnace is about 800 bushels. The buildings are supplied or to be supplied everywhere with water-pipes, to be used both in the ordinary daily operations and in case of fire. Everything about the entire works is constructed for strength and duration. In this respect the company has wisely thought that the additional cost of heavy, strong, and finished work, above that of mere make-shift, cannot fail to be returned in the duration of the works. The machinery in the blast-house is massive, and finely finished. The blast of air is obtained by the use of two large air pumps, whose pistons attach to the ends of a huge walking-beam. The air is forced through a regulator, which serves to keep the current constant. In the regulator, as the machinery was driven yesterday, the pressure of air was five-eighths of a pound to the square inch. From the regulator the air is forced through a long pipe to the top of the stack, when it goes through several large cast tubes, so placed as to be all the time red-hot. This is for the purpose of heating the air before it strikes the fire and mass of ore at the bottom of the furnace. From these heating tubes the air then goes through large tubes, concealed in the masonry, to the bottom of the furnace, where it is discharged with great force into the interior of the furnace. The effect upon the burning mass of coal, ore, and lime is something too fierce for description. To prevent the end of the air-pipe from being consumed by the intense heat, it is inserted in a massive piece of casting, called a *twier*, and which is subjected to a constant stream of cold water.

Making Iron.—The first casting of iron into pigs was made on Saturday, August 24. The manner of doing it is something as follows: Of course the furnace has had fire in it for some time, and was hot when the work began. The workmen first put in at the top 26 bushels of coal, then 800 pounds of ore, adding to this mass about 20 per cent. of limestone. This proportion is observed till the furnace is full. The limestone and ore are broken under the hammer, before being put in the furnace. The use of the lime is to amalgamate with itself all the dross and impurities of the ore, released in the process of smelting. This dross is constantly drawn off from the furnace at the hearth, and when cooled is thrown away. The company propose to use it for grading their roads and grounds. When the reservoir at the bottom gets full, the hearth is tapped, the molten iron runs off in a sparkling white stream, down a channel to the pit, where it falls, first, into a gutter called the sow, and from this into smaller and shorter gutters, where the iron is shaped into pigs. Yesterday the hearth was tapped twice, the result being about six tons of pig iron. It is expected that when the furnace gets formed and thoroughly heated, the company will be able to cast three times at least in 24 hours, making between three and four tons at each casting. The ore now used yields about 55 per cent. of iron, which would be considered anywhere in the world very rich. The coal costs about six cents per bushel. Lime costs $6 per ton. The ore is estimated to cost about $1 75 per ton. The company is now employing 80 men as miners, coal burners and heavers, teamsters and artisans, at the works. The coal-houses now have in them about 80,000 bushels of coal, and it is coming in at the rate of about 2,500 bushels per day. The iron thus far cast is pronounced by Mr. Harris, the superintendent of the works, and by other competent judges, to be equal in quality to any made in the United States. It is very soft and very fine in grain, and it is said, might be worked into castings for machinery as run off from the furnace.

To conclude this article we will mention that of the first casting, Mr. J. C. Trullinger, the proprietor of the town site, has secured two pigs, which he will have engraved with his own initials, the date of casting and the trade stamp of the company, and then planted as street monuments at the corners of blocks Nos. 1 and 2, at the junctions of Furnace, Ladd and Durham streets.

Table of distances.

FROM PORTLAND TO DALLES CITY.

	Miles.	
Vancouver (by steamer)	18	
Lower Cascades	45	63
Upper Cascades (by railroad)	6	69
Dalles City (by steamer)	45	114

FROM DALLES CITY TO LEWISTON.

Celilo (by railroad)	15	
Columbus (by steamer)	6	21
John Day's river	10	31
Indian Rapids	3	34
Squally Hook	3	37
Rock Creek	4	41
Chapman's wood-yard	8	49
Big Bend	6	55
Willow Creek	9	64
Castle Rock	8	72
Canoe Encampment	2	74
Foot of Long Island	4	78
Head of Long Island	7	85
Grande Ronde Landing	5	90
Umatilla City	7	97
Head of Umatilla Rapids	6	103
Wind Mill Rock	3	106
Wallula	15	121
Mouth of Snake river	11	132
First Rapids, Snake river	6	138
Fish Hook Rapid	10	148
Lower End of Cañon	2	150
Upper End of Cañon	2	152
Jim Fort Island	6	158
Pine Tree Rapids	7	165
Palouse Crossing	30	195
Fort Taylor, at Tukannon	5	200
Taksas Rapids	6	206
Pa-na-wa Creek and Indian Farm	25	231
Almota	14	245
Indian Wood Yard	21	266
El-pa-wa Creek	5	271
Jackson & Buckley Ferry	3	274
Lewiston	7	281

FROM DALLES CITY TO UMATILLA CITY.

Celilo (by railroad)	15	
Des Chutes (by land)	1	16
Spanish Hollow	9	25
John Day's	15	40
Willow Creek	23	63
Well Spring	14	77
Ewing's	18	95
Umatilla City	16	111

FROM UMATILLA TO IDAHO CITY.

	Miles.	
Franklin House	12	
Swift's	26	38
Willow Springs	12	50
Meacham's or Lee's Encampment	14	64
Station	13	77
La Grande	12	85
Union	16	101
Pyles	5	106
Kentucky House	1½	107½
Stark's	5	112½
Austin	4	116½
Mountain View House	2	118½
Carter's	6	124½
Valley House	1	125½
Ward's, or Slough House	3½	129
Henkler's Ranch	3¼	132¼
Baldock's	6	138¼
Mud Springs	6	144¼
Illinois Ranch	5¾	150
Straw Ranch, or H. Huffman's	4	154
New York House	4	158
California Ranch	3¼	161¼
Express Ranch	¾	162
Central	2	164
Wilson's	5	169
Hawkins	4	173
Scott's	5	178
Whiteside's	6	184
Miller's	1	185
Marshall's	5	190
Old's Ferry, or Snake River	1	191
Snake River Bend	8	199
Monroe Rouse, or Weizer's	8	207
Jasper & Beard's Station	4	211
Snake River Slough	2	213
Forty-Nine Ranch	10	223
Fayette River and Bluff Station	4	227
Junction House	3	230
Thompson's	4	234
Payette Ranch	8	242
Block House	5	247
Payette Junction	2	249
Bernal's	11	260
Horse Shoe Bend	8	268
Shafer's	4	272
Herzog & Company	4	276
Allen's	10	286
Placerville	2	288
Centreville	5	293
Idaho City	8	301

FROM UMATILLA CITY TO INDEPENDENCE.

Franklin House	12	
Alkali Hollow	12	24
Forks of Birch Creek	10	34
Beard's Saw Mill	12	46
Dealy Ranch	18	64
Horse Ranch	12	76
Day's Flat on Granite Creek	22	98
Independence	6	104

Table of distances—Continued.

FROM INDEPENDENCE TO CAÑON CITY (BY TRAIL.)

	Miles.	
Little Salmon	20	
Vincent's Gulch	18	38
Cañon City	22	60

FROM INDEPENDENCE TO AUBURN.

Head of Powder River	20	
Bear Gulch	5	25
Auburn	15	40

FROM WALLA-WALLA TO IDAHO CITY.

Walla-Walla River	13	
Liukton's Mill	9	22
Mountain House	12	34
Phillips'	13	47
Willow Creek	11	58
Hendershott's	16	74
Union	6	80
Idaho City	200	280

FROM IDAHO CITY TO BOISE CITY.

Warm Springs	2	
Minnehaha Ranch	10	12
Fourteen-mile House	2	14
Sampson's, or Twelve-mile House	8	22
Boise City	12	34

FROM UMATILLA CITY TO BOISE CITY.

Payette Junction	249	
Boise City	30	279

FROM WALLA-WALLA TO BOISE CITY.

(As measured with a roadometer) 265

FROM IDAHO CITY TO ROCKY BAR (BY TRAIL.)

Meadow Creek Ranch	14	
North Boise Bridge and Toll House	4	18
Middle Boise Ranch	6	24
Brady's Ranch	11	35
Rocky Bar	13	48

FROM BOISE CITY TO RUBY AND SILVER CITIES.

Seventeen-mile Station	17	
Slough	15	32
Snake River	1	33
Carson's Ranch	15	48
Honey Lake Smith's	6	54
Boonville	8	62
Ruby City	2	64
Silver City	¼	64¼

FROM BOISE CITY TO VOLCANO.

	Miles.	
Boise River	7	
Fifteen-mile House	8	15
Squaw Creek	15	30
Syrup Creek	11	41
Little Camas Prairie	16	57
Franklin	3	60
Volcano	10	70

FROM BOISE CITY TO ROCKY BAR.

Little Camas Prairie	57	
Wood Creek	8	65
Lime Creek	2	67
Warm Springs	10	77
Cowhide Ranch	5	82
Toll Gate	1½	83½
Milk Ranch	4	85½
Rocky Bar	14	99½

FROM BOISE CITY TO RED BLUFF, VIA BOONVILLE, GIBB'S CREEK, AND SUSANVILLE, IN HONEY LAKE.

Seventeen-mile Station	17	
Slough	15	32
Snake River	1	33
Carson's Ranch	15	48
Honey Lake Smith's	6	54
Boonville	8	62
Jordan's Ranch	18	80
Muskrat Lakes	16	96
Child's Ferry	17	113
Gibb's Creek, or forks of road	8	121
Head of Gibb's Creek	14	135
Mountain Creek	16	151
Trout Creek	17	168
Puebla Mountain	10	177
Hot Springs	6	184
Alder Creek	8	192
Summit Lake	12	104
Three Lakes	12	216
Cañon Creek	9	225
Surprise Valley	13	238
Fur Creek	14	252
Swift Creek	15	267
Rapid Creek	4	271
Susanville, in Honey Lake	6	277
Red Bluff	99	376
Susanville to Chico	95	372

BOISE CITY TO STARR CITY, VIA BOONVILLE.

Seventeen-mile Station	17	
Slough	15	32
Snake River	1	33
Carson's Ranch	15	48
Honey Lake Smith's	6	54
Boonville	8	62
Jordan's Ranch	18	80
Muskrat Lakes	16	96
Child's Ferry	17	113
Gibb's Creek	8	121
Well Spring	12	133
Mouth of Cañon	10	143
Summit Spring	20	163
East Fork of Queen's River	8	171
Paradise Valley	60	231
Cherokee	12	243
Starr City	26	269

Table of distances—Continued.

FROM WALLA-WALLA TO FISHERVILLE, KOOTANIE COUNTRY, BRITISH COLUMBIA.

	Miles.	
Touchet	15	
Spring	11	26
Palouse, on Snake river	20	46
Forks of the Palouse	15	61
Cow Creek	12	73
Camp	12	85
Cottonwood Springs	8	93
Dragoon Encampment	18	111
Pine Timber	8	119
Rock Creek	12	131
Lake to the right of road	13	144
Hangman Creek	10	154
Antoine Plant Ferry, or Crossing of Spokane River	12	166
Dutchman's	17	183
Slough	18	201
Pen d'Oreille Lake	9	210
Head of Pen d'Oreille Lake	30	240
Pack River	9	249
Stampede Lake, to the left of the road	18	267
Kootanie Ferry	18	285
Spring	10	295
Eighteen Mile Creek	8	303
Commission Creek, one mile to left of road	9	312
Round Prairie	10	322
Boundary line	7	329
Moya River	7	336
Third Crossing of Moya River	10	346
Log House	12	358
Miner's Creek	18	376
Peavine Prairie	12	388
St. Joseph's Prairie	12	400
Central Ferry	10	410
Fisherville	7	417

FROM NEW FERRY TO ROCK CREEK.

Springs	15	
Kentuck's, on the first Mullan's road	9	24
Six-mile Camp	6	30
Springs	9	39
Creek	10	49
Timber Camp	9	58
Rock Creek	12	70

FROM WALLA-WALLA TO ROCK CREEK.

By trail, via New Ferry	121
Tukannon to Rock Creek	72

FROM JOHN DAY'S TO POWDER RIVER AND LA GRANDE.

	Miles.	
Scott's	9	
Harrison's on Willow creek	14	23
Forks of Willow creek	6	29
Forks of Butter creek	16	45
Ayers	7	52
Birch creek	20	72
McWillis	17	89
Burk's	16	105
Dealy's Ranch	12	117
Grande Ronde river, or forks of road	4	121
Powder river	20	141
Grande Rond river (road to left) to La Grande	20	161

FROM DALLES CITY TO CAÑON CITY, VIA NIXON'S BRIDGE.

Nixon's bridge	16	
Hay Stack	27	43
Cross Hollows, or forks of road	25	68
Cold Camp	11	79
Current Creek	10	89
Muddy Creek	4	93
Cherry Creek	6	99
Bridge Creek	9	108
Alkali Flat	10	118
Foot of the mountain	9	127
Mountain House	6	133
Camp Watson (military post)	6¼	139¼
Rock Creek	6¾	146
Cottonwood	15	161
South Fork	6	167
Hagen's Ranch	15	182
Veatch's Ranch	8	190
Cañon City	10	200

FROM DALLES CITY TO CAÑON CITY, VIA GILLAM'S.

Gillam's	12	
McItee	17	29
Bake Oven	19	48
Cross Hollows, or forks of road	10	58
Cold Camp	11	69
Current Creek	10	79
Muddy Creek	4	83
Cherry Creek	6	89
Bridge Creek	9	98
Alkali Flat	10	108
Cañon City	82	190

FROM WALLA-WALLA TO LEWISTON.

Tusha Crossing	20	
Tukannon	22	42
Pataha	12	54
Alpowa	12	66
Lewiston	17	83

FROM LEWISTON TO ELK CITY, FLORENCE, AND IDAHO CITY.

Lewiston to Elk City	142
Lewiston to Florence	129
Lewiston to Idaho City	190

From White Bluff to Colville	150

From Wallula via Union to Idaho City, about	300

From Dalles City to Franklin House on the Idaho and Umatilla road	102

ALASKA.

Nearly all the information we possess touching the mineral resources of Alaska is comprised in the correspondence accompanying the President's message, February 17, 1868, (Ex. Doc. No. 177, 40th Congress, 2d session,) and in the speech of the Hon. Charles Sumner on the cession of Russian America to the United States (published in the same document, pp. 124–189.) These valuable and interesting papers contain the researches of the most reliable authorities, and demonstrate beyond question that the newly-acquired territory abounds in the precious metals and useful minerals, though it must be admitted that our knowledge of the country and its resources is, as yet, chiefly confined to the sea-coast and the shores of the Aleutian islands. Of the vast continental interior we know comparatively nothing; in the language of Mr. Sumner, "perhaps no region of equal extent on the globe, unless we except the interior of Africa, or possibly Greenland, is as little known. Here," says Mr. Sumner, "I do not speak for myself alone; a learned German, whom I have already quoted, after saying that explorations have been limited to the coast, testifies that 'the interior, not only of the continent, but even of the island of Sitka, is to-day unexplored, and is in every respect *terra incognita;*' the same has been repeated of the islands also." Without data beyond what has already become familiar to the public, it would be useless, therefore, to encumber this report with any speculations or conjectures respecting the mineral resources of a comparatively unexplored region. It is sufficient to say that Alaska is known to abound in gold, silver, copper, iron, and coal, and that it possesses many other valuable resources, chief among which are its fisheries and forests.

In this enlightened age it seems singular that an acquisition of such inestimable importance, in its political and commercial aspect, to the future of our country—especially to that portion of it lying on the Pacific slope—should meet with opposition on the part of any intelligent American. If the Territory of Alaska possessed no other element of value than its vast forests of pine, spruce, fir, hemlock, and other trees useful for lumber and ship-building, it would be worth more than ten times the sum stipulated to be paid for it under the treaty. A moment's consideration will show how important a question the supply of timber must become to the States and Territories of the Pacific within a comparatively short time. The States of California, Nevada, and Oregon, and the Territories of Arizona, Utah, Montana, Idaho, and Washington, have a united area of 903,019 square miles, with an estimated population of 780,000, or less than one inhabitant to the square mile. The area of timbered land within this vast range of country is almost confined to a narrow strip along the coast north of San Francisco, and to a belt extending along the crests and slopes of the Sierra Nevada and Cascades, varying in width, and at scattered intervals, from 15 to 40 or 50 miles. Reference to the maps will show that this timbered area is less than a twentieth part of the entire surface of the country, and is diminishing perceptibly year after year. The consumption of lumber in California and Nevada, to say nothing of the exports, is without parallel in the history of new countries. Immense quantities of lumber, timber, and firewood are used in the building and supply of towns; in mills, mines, flumes, and fences, and for all the requirements of a miscellaneous and progressive population. It is not to be supposed that, with increased facilities for immigration, the vast tracts of mineral and agricultural land, now sustaining less than one inhabitant to the square mile, will long remain so sparsely settled. Within the next 10 years the population of our Pacific States and Territories will, in all probability, exceed 2,000,000. New towns will spring up at frequent intervals throughout this immense domain. Our scanty timber lands, already suffering from fires and from reckless waste on the part of settlers, will be forced to pay tribute to the increasing population. Estimating the consumption from the rate at which the forests of California have disappeared since 1849, it would not take many years, with a largely enhanced population, to denude all the available timber districts, increase the price of lumber so as to retard the development of many lucrative branches of industry, and probably destroy the export trade in that article, which is now becoming so important an element in the growth of our intercourse with China.

The completion of the Central Pacific railroad will inaugurate a new era for the States and Territories west of the Rocky mountains. With population new sources of wealth will be opened, and railroads will be established north and south, with branches penetrating the mountain passes and valleys in every direction, to supply the wants of many growing and prosperous communities.

If Mr. Secretary Seward had accomplished nothing more in the course of his official career than the acquisition of Alaska, he would for that act alone be entitled not only to the thanks of every citizen of the Pacific coast, already awarded him, but to the gratitude of millions yet unborn, by whom the boundless domain of the west is destined to be peopled.

For the convenience of those who may desire to consult the principal authorities on the resources of Russian America, I have caused to be prepared a chronological summary, or bibliography in brief, of the publications on that region, from A. D. 1600 to 1867. The author, Dr. Alexander S. Taylor, of Santa Barbara, California, is a gentleman of great learning and research, whose labors for the preservation of all the known records of discovery and adventure on the Pacific coast cannot be too highly commended.

Bibliography of Alaska.

1600.—*Hakluyt Rich'd.* Voyages, discoveries, navigations, &c., of the English nation. In two volumes, small folios; London, 1599-1600. Also another volume by the same author of voyages not included in the first work, and not published until 1811, at London, in one volume, quarto; contains the earliest notices of the far northern voyages on the Pacific and Atlantic.

1600.—*Original Documents on the Voyages and Services of Frida Andres de Urdanetta*, pilot of Legaspis Manila expedition in 1565, collected by Martin Fernandez de Navarette, president of the Royal Spanish Academy of History; in one volume, 8vo, in the set of five volumes; Madrid, about 1816. It was Urdanetta who first discovered the currents and winds above 40°, with which he sailed his ships from Manila till he made the north shores of California, and thence down the coasts to Mexico.

1625.—*The Pilgrims of Samuel Purchase*, in three volumes, quarto; London, 1625. Contains the voyage of Juan de Fuca, the Greek pilot, in 1592, for original documents pertaining to which, obtained from the island of Cephalonia, see the author's notes on de Fuca in Hutchings's California Magazine for 1859, also Greenhow's History.

1640.—*Histoire du Noveau Monde*, by Jean de Laet. Folio; Leyden, 1640.

1662.—*The Geography of the World*, by Jean Bleu. Folio; Amsterdam, 1662.

1699.—*De Originibus Americanis*, by George Horne. Folio; Antwerp, 1699.

1712.—*Historical Researches respecting the New World*, by Henric Scherer, professor in the University of Ingoldstadt, Bavaria. In German, about 1712.

1715.—*Recueil du Voyages au Nord*, in nine volumes, 12mo; Amsterdam, 1715.

1704-1750.—*Voyage Collections:* Churchill's Collection of Voyages, 6 vols., folio, 1704-1712; Harris's Collection of Voyages, 2 vols., folio, 1715-1720; Hawkesworth's Collection of Voyages, 5 vols., folio, 1735-1740; Osborne's Collection of Voyages, 2 vols., folio, 1746-1750; account of De Pontes apocryphal voyage through the Northwest Passage in 1640 in the London Monthly Miscellany of 1708; Voyages of Francisco Coreal, 1666-1697, from the Spanish, in 2 vols., 12mo, Paris, 1722.

1722.—*Potheries Historie Amerique Septentrionelle*, in 4 vols., 12mo; Paris, 1722.

1729.—*Origin de los Indios de el Nuevo Mundo y Indies Occidentales*, by Friar Gregorio Garcia; folio, Madrid, 1729.

1753.—*Nouvelles Cartes de L'Amiral Fonte et Autres Navigateurs Espagnoles, Anglais, &c., dans le mer Septentrional*, by G. de Lisle; quarto; Paris, 1753.

1757.—*History of California*, by the Jesuit Father Miguel Vanegas, 3 vols., 12mo; Madrid, 1757, and published shortly after in French, English, and German. Contains notations up to 1752 on the far northwest coast and connections with China, with valuable maps of the north coasts, &c.

1757.—*Researches on the Voyages of the Chinese and Japanese to the American Coasts*, by M. De Guignes; vide Journal Academy of Inscriptions and Belles Lettres; Paris, 1757.

1757.—*Letres Edifiantes et Curieuses, &c., &c.*, of the Jesuit missionaries in all parts of the world, from 1600 to 1760, published in French, with translations in English, Spanish, German, Italian, &c., in some 30 vols., 12mo. Some of the volumes contain exceedingly interesting accounts of the first travels in the far northern parallels of Asia and America, and discoveries of the proximities of the old and the new continents to the north of California and of China. Jesuit writers lay claim to the first mention of this connection to the world of letters and science, and one of the volumes of the *Letres Edifiantes* contains the celebrated narration of Father Greelon, who was transferred to China before 1660, and travelled extensively as a missionary among the Manchoo and Mongolian populations of that empire. In one of his journeys in Chinese Tartary he fell in with an Indian woman of the Huron tribes, whom he had known when serving in the far west of Canada, and who confessed her sins to him as a priest of the Catholic church at this immense distance from her native country. This woman informed Greelon that she had been taken prisoner in an Indian fight, and had afterwards been transferred as a slave from tribe to tribe, until she had crossed in boats over a piece of water, which was salt, and again sold from one person to another until conveyed to the plains of Tartary. This fact is said by some to have first stimulated the attention of the Russian authorities, which resulted in the discovery of Behring Straits and Alaska. It was the redoubtable old sailor, Peter the Great, and after him his wife, the Empress Catherine, who set afloat the great discovery voyages of Vitus Behring and Alexander Tschirikoff in 1728–'29 and to 1741, which sailed from Kamschatka, and discovered the straits which separated Asia from America, and fully confirmed the speculations of the old Jesuit missionaries of Canada, California, and China. (See the curious map of the Pacific in the Spanish edition of Venega's California. See also on this curious subject of Asiatic and American ethnographic connections the celebrated work "*Melanges Asiatiques*" of A. Remusat, and the notes of Kurz in the *Nouvelle Journal Asiatique* on Chinese history.)

1774.—*Discoveries of the Russians on the Northwest Coasts of America*, &c., by Von Muller; quarto, London, 1774. Contains the earliest Russian voyages to Pacific America.

1774.—*Account of the Northern Archipelago to the east of Kamtschatka, &c. &c.*, by J. Von Staehlin. 1 vol., 8vo, London, 1774.

1778.—*American Atlas*, or description of the whole continent of America, in grand folio, by Thos. Jeffreys; London, 1778.

1780.—*Discoveries of the Russians in the North Pacific*, by Rev. Dr. Wm. Cox; quarto, London, 1780. Contains the accounts of Behring's voyage of 1741, and other valuable histories.

1780.—*Journal and Proceedings of the Imperial Academy of St. Petersburg*, from 1780 to present time; many volumes.

1781.—*Historical and Geographical Miscellanies*, by Hon. Daenis Barrington, 1 or 2 vols., 8vo; London, 1781. Contains papers on extreme North Pacific coasts.

1788.—*The Apocryphal Voyage of Francisco Maldonada through the Northwest Passage*, published in Madrid about 1795 by the Royal Academy of History, from MSS. discovered in the Ambrosian library of Milan. Also, Cevallo's Voyages of Maldonada, De Fuca, and Fonte, 1 vol., 8vo, Madrid, 1798.

1789.—*Voyage of Captains Portlock and Dixon to the Northwest Coasts of America, &c., &c.*, in the King George and Queen Charlotte, in 1788–'89; quarto, London, 1789.

1789.—*Dissertation Geographico de Novo California, &c.*, by J. A. Hartman; quarto, Marburg, 1789.

1789.—*Relation of a recent Spanish voyage to the northwest coasts of America, ante* 1789, by J. F. Bourgoing. 3 vols., 8vo, (French) 3d edition, Paris, 1803.

1790.—*Cook's Voyages.* The three voyages of Captain James Cook between 1766 and 1776, to the Pacific and northwest coasts. The only reliable editions, which are in several volumes, are those published under the directions of the Lords Commissioners of the Admiralty of England, printed at London at separate periods before 1792.

1790.—*The Voyages of Captain Billings to Behring Straits, Kamstchatka, &c., &c.*, 1785–1790, in the Russian service, by Martin Saner; quarto, London, 1796.

1790.—*Voyages made in* 1788–'89 *between China and Northwest America*, by Captain John Mearres, R. N.; quarto, London, 1790. Captain Dixon's reply to the same, 1 vol., quarto, London, 1790.

1791.—*Journal of the Voyage of the Spanish Exploring Ships Atrevida and Discubierta*, under Captain Alexander Malaspina, in 1791; preserved in MSS. in the viceroy's library in Mexico and in the Spanish hydrography at Madrid Malaspina's charts were published in a quarto volume by the Spanish government about 1802, and credited to the voyage of the

Sutil and Mejicana, and afterwards became the established authorities in the Spanish marines for the north Pacific coast down to 1830.

1792.—*The Viceroy's Archives of Mexican History*, collected and arranged under orders from Viceroy Revilla Gigedo by Father Francisco Garcia Figueroa, and arranged in 32 or more folio volumes, and now in the old viceroy's library in Mexico City. Perfect copies of this valuable collection are stated to have been also sent to Madrid before 1800. It contains invaluable material, collated by Cassasola and Bonilla, on the Spanish discovery voyages to that portion of ancient Alta California between the latitudes 55° and 61°, as claimed by Spain, which afterwards became the domain of Russian America, and now forms a portion of the United States Territory of Alaska. See also contribution of Secretary Seward, in 1865, on Spanish northwest voyages, contained in the Bibliografa Californica of the author.

1793.—*Voyages and Travels in Asiatic Russia and in the North Pacific*, compiled by Professor Pierre Simon Pallas; 4 or 5 vols., quarto, Paris, 1789-'93. There are also English editions of the works of Pallas, who was a celebrated German professor in Russia under the patronage of the Empress Catharine II. This appears to be the same work edited or completed by Theodor K. de Mirievoy, and which contains such valuable material on the philology of Europe and Asia. Pallas also wrote extensively on the natural history of Russian America in German. Pallas was one of the greatest naturalists of his day, and his writings covered a multitude of subjects. His notations on the locust and grasshopper ravages in the Crimea, noticed by the learned Russian entomologist, Motschulsky, and also by the author of this bibliography in the Smithsonian report for 1859, are of great value in science.

1793.—*Voyages and Travels to the Coppermine River and the Countries west of Canada in* 1789-'93, by Alexander Mackenzie; in 8vo and quarto, London, 1801 and 1802. The work of Samuel Hearne, describing his voyage of 1770-1772 in some of the countries visited by Mackenzie, and for the discovery of copper mines, was published in London in quarto in 1795.

1799.—*Voyage round the World*, by Captain Jean Francois G. de La Perouse; edited by M. Millet Muriau. Government edition in French, 4 vols., quarto, 1797, maps and illustrations; also English and German editions.

1799.—*Voyage to the Northwest Coa ts of America and Round the World*, 1790 to 1792, in the French ship Solide, by Captain Etiene Marchand, preceded by an historical introduction of discoveries, &c., on the northwest coasts of America, by Claret Fleurell, (in French,) in 4 vols., quarto, Paris, 1799.

1801.—*Voyage of Discovery and Exploration on the Northwest Coasts of America in* 1790 *to* 1795, *&c., &c*, by Captain George Vancouver, R. N.; plates and maps; published by the government in 5 or 6 vols., quarto, London, 1801. Lieutenant Broughton, an officer of one of Vancouver's vessels, also published an account of the voyage in quarto form at London, in 1804.

1802.—*Voyage of the Sutil and Mexicana*, exploring vessels, under Captains Dionisio Galiano and Cayatano Valdez, of the Spanish navy, in 1792, to the northwest coasts; published by order of the King of Spain, in 1 vol., 8vo, in 1802, with map. The Memorias sobre las Observaciones Astronomicas que han servido de fundamentos a las Cartas de la Costa Norweste de America, written about 1810 by Admiral Espinosa, of the Spanish navy, and published by the Hydrographic office of Madrid, is spoken of by Humboldt as a work of value.

1805.—*Catalogo de las lenguas Conocidas, y numeracion, division y clases de estas, segun la diversidad de sus idiomas y dialectos*, by Father Lorenzo Hervas, soc. Jesuits, in six vols., quarto, of nearly 400 pages each. Published at Madrid 1800 to 1805; also in octavo.

1806.—*The "Mithradates oder Allgmeine Sprachinkunde mit dem Vater als Sprachbone,"* &c., a famous authority in the philosophy of languages, was commenced by John Christopher Adelung, of Berlin, in 1806, and concluded by John Severan Vater, in 1817, in five vols., 8vo, at Berlin. Another work was published by Frederick Adelung, in 1815, at St. Petersburg, in quarto, entitled "Catherinas der Grossen Verdienste," &c., &c. The Mithradates contains valuable matter on the Indian languages of the far north Pacific coasts.

1811.—*Works of Alexander Humboldt*. A critical examination of the history, navigation, and geography of the New World and the progress of nautical astronomy in the 15th and 16th centuries; in French, 5 vols., 8vo, Paris, 1836-'39. Also, Researches concerning the Institutions and Monuments of the Ancient Inhabitants of North America, with descriptions and scenes in the Cordilleras, plates, maps, and plans; in 2 vols., folio, Paris, 1810; London edition, 2 vols., 8vo, 1814. Also, Essay on the Kingdom of New Spain, in 2 vols., folio, Paris, 1808-1811, plates, maps, and plans; London edition in 4 vols., 8vo, 1811; also a New York edition in 2 vols., 8vo, 1811. All these works contain valuable notations on the Alaskan countries.

1812.—*Puteschestwil W. America*, by Chvostov I. Davidoff. 2 vols., 8vo, St. Petersburg, 1812.

1814.—*Voyage Round the World in the Russian ships Neva and Nadedsda, in* 1803-1806, commanded by Adam John Von Kruesenstern, (afterwards admiral in the imperial navy.) English edition, in quarto, London, 1814, with maps, plates, &c. Also, Berlin edition. The other works published on this voyage by Kruesenstern's officers are Dr. Langsdorff's work, in 2 vols., quarto, London, 1816, and Captain Wrey Lisiansky's, in 1 vol., quarto, London, 1814. They were also all published in different forms in the Russian language and in French. Admiral Kruesenstern also wrote a work of 78 pages on the Indian languages of Alaska, for the St. Petersburg Academy, in 1813. He was also the most thoroughly instructed seaman in the world on the hydrography of the Pacific, and compiled those charts of the great ocean which are the models of all others, all of which, with his nautical notes and memoirs accompanying these, have made him celebrated among the savans of America and Europe. Before his death, about 1850, he had filled many posts of the highest honor in the imperial service, and was a man of the most estimable personal character.

1817.—*Collection of Voyages in the South Seas and the North Pacific, from* 1527 *to* 1800. By Admiral James Burney, R. N. In 6 vols., quarto, London, 1814-1817; with plates, charts, &c. This valuable work contains very little on voyages after 1770.

1817.—*The American Coast Pilot, &c.* By Edmund Blunt, of New York. The editions of this well-known work subsequent to 1850 contain valuable notices of the hydrography of Russian America and the northwest coasts. The same may be said of "The American Navigator," by N. A. Bowditch; but the editions of both works prior to 1850 are very meagre on the coasts mentioned.

1818-34.—*Voyage to California and the North Pacific Coasts, in the French trading ship Bordelais.* By Captain Camile Rocquefeul. 2 vols., 8vo, Paris, 1823. *Voyage Round the World in the French trading ship Heros, in* 1826-1829. By Captain Duhaut Cilley. In 2 vols., 8vo, Paris, 1834. Both these works relate to California and the coasts further north, and contain much interesting matter on the fur trade of the epoch *ante* 1830.

1823.—*Voyage of Discovery to the Pacific Ocean and Behring's Straits, California, &c., in the Russian ship Ruric, in* 1815-1818. By Captain Otto Von Kotzebue, (afterwards admiral in the imperial navy.) In 3 vols., 8vo, London, 1823. Editions also in German and French. Chamisso was the surgeon and naturalist of the Ruric, and for many years after made valuable contributions to the learned societies of Russia, Germany, and France, on the fauna and flora of the countries visited, particularly of Alaska. Kotzebue also made another voyage to Russian America, the central Pacific islands, and California, in 1823 to 1826, in the Russian ship Enterprise, or Predpriate, an account of which was published in English at London in 1830, in 2 vols., 8vo. In this voyage Eschscholz went as naturalist, and after his arrival in Russia contributed valuable material on the fauna and flora of Alaska, California, &c., in different German, Russian, and French journals of learning and science, which are highly esteemed. Choris, the artist of Kotzebue's voyage, who was afterwards killed in Mexico, also published an illustrated work on the voyage, entitled "Voyage Pittoresque." These two voyages of Kotzebue are often confounded *as one*, and the names of Chamisso and Eschscholz, which Kotzebue attached to certain localities in Alaska, are sometimes mistaken for Indian or Spanish terms, and both as members of one expedition. Admiral Kotzebue served in the Crimean war, and was highly esteemed by his government, and a hydrographic author of eminence. He died, we believe, in 1858.

1824.—*Voyage to Russian America &c.*, by M. Chromtschenko; vide St. Petersburg Archives of History, &c., &c., for 1824; also in German in the periodical Hertha, for 1824. Chromtschenko and Etoline made surveys of the Alaskan coasts, which were reduced to charts and maps.

1831.—*Voyage of the ship Blossom to the North Pacific and Behring's Straits in* 1825 *to* 1828, *to co-operate with the Arctic Expeditions from the Atlantic.* By Captain F. W. Beechey, R. N., (afterwards admiral.) Published under orders of the British Admiralty. In 1 vol. quarto, also in 2 vols., 8vo, London, 1831; both with plates, maps, &c. A quarto volume on the natural history of the voyage was also published at London in 1839. The botanical collections were edited by Sir William J. Hooker and others, in the separate volumes included in the *Flora Boreala Americana*, published in 2 vols., quarto, about 1840, and Hooker's *Plantae Iconii*, of 1844. A large amount of valuable material relating to Alaska is to be found in all these volumes. Admiral Beechey, we believe, died in London in 1859.

1836.—*Voyage to the North Pacific in the Russian ship Seniavine, in* 1826-'29, by Captain Frederick Lutke, (now admiral in the Imperial navy,) in 4 vols., 8vo; St. Petersburg and Paris, 1835-'36. This is one of the most valuable works on Russian America and the north Pacific. The author served in the Crimean war of 1856.

1839.—*Baer, Von K. E. Statistics and Ethnography of the Russian American Countries.* This author, it is said, was with Admiral Von Wrangel when governor of Sitka, and made valuable contributions on the above subjects and on natural history to the scientific journals of St. Petersburg and Berlin, between 1837 and 1845.

1839.—*The Physical History of Man.* In 2 vols., 8vo, plates; 1839. *The Natural History of Man.* In 2 vols., 8vo, plates; 1855. Both by Dr. J. Pritchard, of London, and esteemed as high authorities in ethnology. They contain valuable matter on the Alaska Indians. The volumes of transactions of the ethnological societies of New York, London, and Paris also contain accounts of the tribes of the Territory to be found in no other publications. In this category are also the learned ethnological works of Dr. S. G. Morton, of Philadelphia, from 1840 to 1850.

1839.—*Beitrage zur Kentniss des Russian Reichs, und der angranzanden Lander Asies*, by K. E. Von Bar and G. Von Helmersen, in several volumes, from 1839 *et sig.*

1840.—*Notes on the Islands of the district of Unalaska, &c.*, in 3 vols. 8vo, 1840. Also notes on the Koloschon and other Russian American Indian tribes and their languages, in 1 vol., 8vo, 1846, by the Greek Priest Jvan Veniaminov, (in Russian,) both published in St. Petersburg. W. Schott also published some philological papers on the Koloschon language, in Erman's archives, Berlin, 3d vol., 1843

1843.—*Voyage of the Sulphur to the North Pacific, &c., in* 1837–1841, under Sir Edward Belcher, R. N., (now admiral.) In 2 vols., 8vo, 1840. The zoology of the expedition, in quarto, was published in 1843–45. These accounts relate largely to Russian America. They are government works.

1844.—*Explorations, &c., in the two Californias, &c., &c., in* 1840–43. By Duflot de Mofras. In 3 vols., 8vo, with volume of atlas and plates. Paris, 1844. Government work. Contains notices of Alaska and its trade, Indians, &c.

1844.—*Anales de la Philosophie Chretiene.* Vol. 15 and others. Contains papers of M. Prevaney on the ethnological connections of Alaska and Mexico by the Mongolian races.

1845.—*Overland Journey Round the World, &c.* By Sir George Simpson, governor of the Hudson Bay territories in 1841–42. In 2 vols., 8vo, London, 1845. Also in New York.

1845.—*Exploring Expedition Round the World*, in the Vincennes and other government vessels of the United States, in 1838–42, under Lieutenant Charles Wilkes, (now admiral U. S. N.) In 5 vols., imperial octavo. Government work, 1845. Plates, maps, charts, and plans. Some 40 volumes altogether were published on the results of this expedition, many of which contain more or less valuable of scientific matter on Alaska. A number of the officers of the expedition afterwards served in California from 1846 to 1867.

1846.—*L'Oregon et les Cotes du Norde Pacifique, &c.* By M. Felix. With map; 1 vol., 8vo. Paris, 1846.

1846.—*Ethnology and Philology of Wilkes's Exploring Expedition.* By Horatio Hale. 1 vol., quarto. Philadelphia, 1846.

1847.—*History of Oregon, California, and the North Pacific Coasts.* By Robert W. Greenhow. 1 vol., 8vo, 4th ed., Boston, 1847. Mr. Greenhow was United States attorney for the California Land Commission of 1852, and died in San Francisco in 1856. His work contains valuable notations on Alaskan history.

1847.—*Studies on the Primitive History and Antiquities of the Races of America and Oceanica*, by Gustave D'Eitcthal, 2 vols., 8vo. Fragments on the History, Geography, &c., of America, by C. F. Jomard; 1 vol., 8vo. Both these works were published (in French) at Paris in 1847.

1848.—*Volume of Charts and Maps on Russian America, &c.*, printed by the lithographic press at Sitka in 1848.

1849.—*The Collections of Lieutenant Zagoskin, of the Imperial navy, on the Indian Tribes and Languages of Alaska*, are printed in the Memoirs of the St. Petersburg Geographical Society for 1847–'48–'49, *et seq.*, and also in his work of travels, in 2 vols., 8vo.; St. Petersburg, 1847–1848.

1850–'60.—*Orography, &c., of the North Pacific Countries*, by Professor Grewingk, published in Transactions of the Mineralogical Society of St. Petersburg, and also in Germany. This is stated by Mr. Sumner to be a very valuable work, particularly on the mineral developments of Alaska.

1850.—*National History of the Varieties of Man*, by Dr. R. G. Latham. 8vo, London, 1850.

1851.—*Sir John Richardson's Arctic Expedition.* 2 vols., 8vo, London, 1851.

1851.—*A Nautical and Historical Directory of the Pacific Coasts and Islands, &c., &c.*, by Alexander G. Findlay; 2 vols., royal 8vo, London, 1851. This is a work of great merit, and one of the best compiled on oceanic hydrography, and has been of great utility. The author is well known in England, and an eminent collaborator in the proceedings of the Royal Geographical Society. His notations on the Alaskan coasts are from the best authorities of Russia and other nations.

1852.—*Voyage of the ship Herald*, under Captain Hy. Kellet, in 1845 to 1851, being three cruises to the Behring's straits countries and a voyage round the world; by Dr. B. Seeman; 2 vols., 8vo, 1853. Other volumes on the natural history of the voyage were published by Prof. Edward Forbes, 1 vol., quarto, 1853. A separate volume was written by Dr. Seeman on the botany of the voyage, in quarto. All of them are in high esteem in the learned world. See also the volumes of Sir Leopold McClintock on his voyage to Behring's straits and the Arctic, of 1852 to 1854; also, the volumes of the London Nautical Magazine. The work of Seeman contains the model of an exploring voyage, and is the most convenient thing of the kind we have ever seen.

1855.—*Admiral Von Wrangel.* This gentleman, who several times visited California, was governor of Russian America before 1848, and wrote largely in the Russian and German journals on the status and natural history of Alaska. His works are considered of first-class merit.

1855.—*Notices of the Crustacea and other Invertebrate Marine Animals of the North Pacific Countries*, by Professor William Simpson, surgeon, &c., of the United States North Pacific expedition of 1854-'56. These notices were published in the transactions of several learned societies of Philadelphia, New York, and Boston, from 1855 to 1863, and would now make 12mo. of some 300 pages, and have become standard authorities in natural science. The author is well known in California, has contributed valuable services to the Smithsonian Institute, and is now in charge of the Chicago Museum of the Natural Sciences. His notations on the invertebrate animals of the Alaskan coasts are extremely interesting and curious.

1855.—*Transactions of the California Academy of Natural Sciences*, in 4 vols., 8vo, from 1855 to 1866; contains several valuable papers on the natural history, &c., of Alaska, by writers of the Pacific domain.

1855.—*The Birds of Texas, California, Oregon, &c.*, by John Cassin, in 2 vols. quarto; Philadelphia, 1855; with plates. Also the volumes of John J. Audubon on the Biography of North American Birds, and his great work of accompanying plates, all published before 1855. The Quadrupeds of North American is a celebrated work; also written by Audubon and Dr. John Bachman, 1840-'43. All these volumes are splendidly illustrated, and relate largely to the natural history of Alaska.

1857.—*John C. E. Buschmann, Librarian of the Royal Library of Berlin.* The philological treatises of this eminent savan on the Indian languages of Russian America, and showing their relations to the Athabascan families west of the Rocky mountains, and comparisons with the northern tribes of Mexico, are contained in the volumes of Transactions of the Royal Academy of Berlin since 1850.

1857.—*The North Pacific Exploring and Surveying Expedition*, by Lieutenant A. W. Habersham, U. S. Navy; 1 vol., 8vo, 1857.

1857.—*Three Years in Washington Territory*, with notices of the northwest coasts, by Jas. G. Swan; 1 vol., 12mo, New York, 1857.

1857.—*Mission to the Government of Japan*, by Commodore M. C. Perry, U. S. Navy; in 3 vols., quarto, 1857, copiously illustrated. Contains highly valuable notices on the hydrography of the north Pacific, its great sea currents, &c., &c.; government work.

1857.—*The Pacific Railroad Survey volumes*, from 1853 to 1858, in 12 vols., quarto, copiously illustrated. The first volume and the 8th, 9th, and 10th contain valuable notations on the Indians, birds, fishes, and animals, &c., of the Pacific domains and of Alaska. In the eighth and ninth volumes may be found Spencer F. Baird's Bibliographies of American Natural History, where all the authorities on Alaskan zoology are set forth.

1858.—*Reports of the United States Coast Survey Office*, in quartos, since 1853. That of 1858 contains the excellent directory of George Davidson of the coasts of California and to the far north, and incidentally of Alaska.

1858.—*Literature of the Aboriginal Languages of America*, by H. E. Ludewig; with additions by W. W. Turner and N. Truebner. 1 vol., 8vo., London, 1858.

1860.—*Chinese Repository.* An English magazine published at Canton since 1838, and making now over 30 volumes. It contains an immense amount of matter on Asiatic literature, and has papers on Alaska and Kamstchatka. It was first edited by an American missionary from Massachusetts.

1860.—*Geographical Dictionary of all the Countries of the World*, by J. B. McCulloch; in 2 vols., royal 8vo, London, 1855, and recent editions.

1860.—*The Forest Trees of North America*, by Dr. J. G. Cooper, of California; in Patent Office Report for 1860. This is an addendum to the great work of Michaux and Nuttall.

1860.—*The Flora of North America*, by Dr. John Torrey and Dr. Asa Gray; in royal 8vo volumes. Also, their continuations in the volumes of the Railroad Surveys.

1860.—*Smithsonian Institution.* The volumes of annual reports of this Institution, and those entitled "Contributions to Knowledge," contain several valuable notations on the Indians and natural history of Alaska. Major Robert Kennicott, of Chicago, one of their most famous assistants, and who explored the eastern sections of Alaska in 1862-'64, died at Michaelowski, in that Territory in May, 1866, while engaged in explorations connected with Bulckley's Telegraph Survey. The manuscripts of his travels are said to be in possession of his friends in Chicago and the Smithsonian Institution.

1860.—*The Indianology of California*, including notes on the Indian tribes of Alaska and other portions of the Pacific domain: published in the California Farmer newspaper in four series of 150 numbers, from 1860 to 1864, by Alex. S. Taylor; perfect set in the mercantile library of San Francisco, and the library of the Smithsonian Institution. The valuable papers of the late Albert Gallatin on the northwest Indian nations are to be found in the volumes of the New York Ethnological society, after 1845.

1860.—*The Geography of the Sea*, by Lieutenant M. F. Maury, 8th edition, New York, 1861; also his Wind and Current Charts of the Pacific ocean. This author was Superintendent of the National Observatory at Washington, and afterwards became an admiral in the rebel service of the southern confederacy. The work contains valuable notations on the winds and currents of the North Pacific.

1861.—*The Vegetation of the Coasts and Islands of the Pacific*, from the collections on the voyage of the Russian ship Seniavive, under Captain Lutke, 1826-1829, by P. H. Von Kitlitz, in quarto, published in Germany, in 1861.

1861.—*History of the Discovery of the Earth*, by Carl Von Ritter; London, 1861.

1861.—*History of Eastern Asia, Mongolia, China, Manchuria, the Amoor, Kamtschatka, &c., &c., &c.*, by Professor Frederick C. Neuman, of Munich and Berlin; London, 1861.

1862.—*Discoveries in northern Pacific from Mongolian Asia, before the times of the Icelanders*, (*A. D.* 500.) These are said to be written by Mr. C. G. Leland, and published in the Knickerbocker and Continental magazines of 1848 and 1862, and are mostly, as is understood, from the work of Professor F. C. Neuman, of Munich and Berlin.

1862.—*History of the Discovery and Chartography of the Pacific and Atlantic coasts of North America*, by Dr. John G. Kohl. 1 vol., 8vo, London, 1862.

1863.—*Report to the Imperial Government on the Resources of Russian America, &c.*, with notices of British Columbia, California and the north coast countries, in 1860-'61, by Captain P. N. Golownin; St. Petersburg, 1863. Also published in some periodical in numbers, and, as is said, in English.

1863.—*Les Peuples de la Russie.* This we judge, from Sumner's remarks, is a very voluminous and valuable work on the populations of the Russian empire, published about 1863. (See also the Almanach de Gotha for 1867, on the same subject.)

1864.—*Travels in the countries of the river Amoor, with Notices of Russian America and North Pacific Commerce*, by Major Perry D. McCollins; 1 vol., 8vo; New York, 1864. This was written in furtherance of the great enterprise of the telegraph connecting North America and Asia.

1865.—*Atlas for the History of the Discovery of America*, compiled under direction of the Royal Academy of Munich. This collection is made by photographing old and scarce maps on the Americas to the number 13, and 100 copies of the work were published in 1865, at Munich, at the price of $18. Some of these, relating to the northwest coasts before 1571, are taken from a scarce and celebrated chartographical collection of the Portuguese scholar Vaz Dourada. (See notes of Professor F. C. Neuman, in the San Francisco Evening Bulletin.)

1867.—*Speech of Senator Sumner, of Massachusetts, in the United States Senate, in May,* 1867, *on the purchase of Alaska, and the resources, &c., of the Territory.* Pamphlet, 8vo, of 48 pages and large map of the Territory and vicinities. The discussions on the transfer of Alaska in the United States Congress will be found preserved in the volumes of the Congressional Globe, written down by the official reporters, in 1867.

1867.—*The official correspondence* between Secretary Seward, of the State Department, and the Russian diplomats, on the purchase and transfer of Alaska, will be found at large in the volumes accompanying the President's message for 1867-1868, from April to December, 1867. (See also the San Francisco newspapers.)

1867.—*New Map of Alaska.* A new and extended map of Russian America was prepared in May, 1867, by the officers of the coast survey in California, which is stated to be detailed from the most recent authorities, and the best to date.

1867.—*Bulckley's Telegraph Survey.* The officers of this expedition are stated to be engaged in the preparation of a work on the Explorations of British Columbia and Alaska, connected with this great enterprise.

1867.—*Sea Charts.* Some excellent navigating charts of the North Pacific coasts have been within the last 18 months issued from the admiralty office of London. These contain the most recent and reliable notations prior to the Coast Survey map mentioned in the foregoing.

1868.—*Letters to the New York Tribune and Boston Advertiser.*

1868.—*Letters and speech of Senator Cole*, of California, in favor of the acquisition of Alaska.

GENERAL OBSERVATIONS ON THE PACIFIC SLOPE.

PROGRESS OF SETTLEMENT—IMMIGRATION AND LABOR.

SECTION I.

INFLUENCE OF MINING ON OTHER INTERESTS.—Within the brief space of nineteen years our people have opened up to settlement a larger area of territory, valuable as a source of supply for nearly all the necessities of man, than has ever before in the world's history been brought within the limits of civilization in so short a time. Nineteen years ago California, Arizona, Colorado, Montana, Idaho, Washington Territory, Oregon, Utah, and Nevada, occupying more than one-third of the entire area of the United States, were regions chiefly known to trappers and traders; traversed and occupied for the most part by barbarous hordes of Indians. That this extraordinary advance, with all its concomitant results to the trade and commerce of the world, has been achieved by the discovery and development of our mineral resources, no reasonable man pretends to dispute. Every day's progress in our history speaks for itself, and the facts are patent to all.

It seems a little singular, considering the millions of treasure thus added to our national wealth, the vast range of industry opened to our people, the wonderful impulse given to agriculture, commerce, and manufactures, that of all our great national interests, the business of mining has had the hardest struggle to enlist the favorable consideration of our government. Of late years, through the irresistible logic of results, something has been achieved in the way of more intelligent federal legislation.

The mineral land law, of July 28, 1866, granting titles in fee to the miners, is an advance in the right direction. The appropriation for the collection of mining statistics is another.

There are in the Atlantic States many who will speak of mining as an interest inimical to the welfare of a people, owing to its fluctuating and hazardous character, and to the contempt it is supposed to beget for the more gradual methods of acquiring wealth. There is much truth in this view when it is confined to the early style of mining, which despised restraint and debauched the morals as it impaired the constitutions of those who followed it in a spirit of wild adventure. But the objection does not lie against mining as a regular, systematic pursuit, directed by skill and capital, and relying upon the steady continuance of moderate profits. This kind of mining, by common consent, is destined to be one of the most permanent and healthful sources of prosperity. The application of American ingenuity and enterprise to the development of the deposits of precious metals found west of the Rocky mountains, is certain ultimately to make mining for gold and silver as legitimate and safe a business as mining for coal and iron, and as great a promoter of diversified industry.

If we take mining only in its past condition and its present transition state, we must admit that with all its evil effects upon individuals, it has caused most important general benefits, especially in anticipating by generations the peopling of the immense Territories of the west, and thus widening the field for the display of national energies, broadening the spirit and firmly bracing the national credit. But for the mining furor of the last 19 years, California would probably have remained a vast cattle range to this day, and all the great Territories that adjoin it, now peopling with civilized communities, and nearly traversed by a railroad uniting both shores of the continent, would still be savage wastes, held and controlled by the barbarians who are fast retiring before the forces of modern progress.

The direct effect of mining upon agriculture and commerce is strikingly shown in California. How much wheat would now be exported from San Francisco but for the mines and the population attracted by them? How many interior towns would have been built; how far would the Pacific railroad have been constructed; where would have been the overland mail and telegraph, and the China steamship line, but for the necessities created by the development of our mineral wealth? The mines have not only led to these things, but they have built up a great manufacturing interest, which already, in San Francisco alone, estimates its annual product by a figure nearly as high as that of the gold fields.

The truth is, agriculture, commerce, manufactures, and mining, are essentially homogeneous pursuits. The only antagonism is one of wrong methods, and these are sure to be rectified in time. In some quarters of the globe it is commerce that leads, in others agriculture, in others mining. The last has been especially conspicuous as a motor of emigration and industrial development in the Pacific States, and has caused the others to flourish where nothing else could have attracted them for a long time later. The rich silver mines of Nevada have peopled that State with an industrious and thriving population. Farms are seen where sage-brush deserts existed a few years ago; the rugged declivities of the mountains abound in gardens. On the western slope of the Sierra Nevada we have luxuriant orchards and vineyards, in the place of endless forests of pine. Baron Humboldt, the most learned of travellers and most acute of observers, tells us that the best cultivated fields of Mexico are those which surround the richest mines; and he bears testimony to the fact that "wherever metallic veins have been discovered, in the most uncultivated parts of the Cordilleras, on the isolated and desert table-lands, the working of mines, far from impeding the cultivation of the soil, as it is generally imagined, has been singularly favorable to it." And the reasons he gives are conclusive:

> Want soon awakens industry. The soil begins to be cultivated in the ravines and declivities of the neighboring mountains, wherever the rock is covered with earth. Farms are established in the neighborhood of the mines. The high price of provisions, from the competition of purchasers, indemnifies the cultivator for the privations to which he is exposed from the hard life of the mountains.

The truth of these observations is strikingly illustrated by the example of California. But mining in that State has a still more direct influence upon the development of our agricultural resources than the direct demand it creates in the mining districts for agricultural products. The vast net-work of ditches in the central counties has inaugurated a system of irrigation which may some day be almost as indispensable to the farms, orchards, and vineyards of the dry uplands as to the placer diggings. No purely agricultural interest could bear the expense of constructing these immense ditches, some of which range from 50 to 60 miles in length, and cost singly several hundred thousand dollars. Most of these ditches will be available for purposes of irrigation and manufacture, long after the original occasion for them shall have passed away.

That the agricultural and manufacturing will be far in advance of the mining interests of California within a few years, none who have studied the market and shipping lists for the past year or two can doubt; nor can it be denied that this is a matter of congratulation, for while mining is so efficient as a stimulating and co-operating industry, it is not the most solid or genuinely productive and lucrative industry, and all human experience shows that a people never attain the highest prosperity and the best culture who are largely devoted to a single pursuit. Humboldt says "the influence of the mines on the progressive cultivation of the country is more durable than they are themselves." While it must be admitted, therefore, that "the produce of the earth derived from agriculture is the sole basis of permanent opulence," it is but just to say, so far at least as the Pacific coast is concerned, that the working of mines has tended more than all other causes to the development of that pre-eminent branch of industry.

Although the business of mining has not advanced in any remarkable degree during the past year, the average yield is fair, and greater confidence exists than ever before in the profits to be derived from this pursuit when conducted upon legitimate principles. The depression in mining stocks, so far from affording evidence of any actual decline in the value of the mines, is a healthy indication. It proves that the era of reckless speculation which has resulted so disastrously to thousands of our citizens is drawing to a close. It presents conclusive evidence that a system of mining based upon the fluctuations of a stock market can never be permanently prosperous. Wherever the mines are carefully worked by individuals or by companies we find the average of success quite as great as in other branches of industry.

It is manifest, however, that quartz-mining, apart from the hazards naturally incident to it, labors under disadvantages which do not pertain, in so great a degree, to any other pursuit. It requires a greater amount of capital and the employment of a larger number of men than any other productive branch of industry, excepting, probably, manufactures, which are not subject to the same risks. Taking the aggregate of losses and profits on all the investments made in quartz-mining, there is no business, so far, on the Pacific slope which has proved less remunerative to capitalists.[*]

Cost of Labor and Expenses of Living.—A serious obstacle to the prosperity of the mining interest on the Pacific slope is the high cost of labor. It is impossible that any mine, however productive, can long continue to bear the drain upon its resources necessary, at the present rate of wages, to defray the expenses of working it. There are innumerable mines in every State and Territory west of the Rocky mountains now idle, which could be worked at a profit if the expenses of labor were not so disproportionate to the cost of living. Wages are still in many instances more than double what they are in the Atlantic States, and tenfold more than the wages paid in Europe. The question arises, why should this be the case, when the cost of living is now but little greater in many of the mining districts than in the Atlantic States, and certainly bears no proportion between the wages paid and the cost of living in Europe.

In California the rate of wages for unskilled labor in the mines is $2 50 to $3 per day; cost of board and lodging, $5 to $7 per week. In Nevada, wages $4 per day; living, $7 to $10 per week. In Montana, wages $6 per day; living, $10 to $14 per week. In Idaho, wages $5 to $6; living, $9 to $12 per week. In Oregon and Washington, $1 50 to $2 50 per day; living, $4 to $6 per week. Skilled labor varies greatly, according to the demand and supply. The following rates paid in Virginia, Nevada, for the various grades of labor, may be taken as a medium illustration:

	Gold.
Ordinary miners, per shift of eight hours	$4 00
Carpenters and millwrights, per day	5 00
Stone and brick-masons, per day	6 00
Engineers, second class, per day	$5 00 to 6 00
Engineers, first class	6 00 to 8 00

MILL HANDS, TWO SHIFTS IN 24 HOURS.

Amalgamators and feeders	3 00 to 3 50
Rock-breakers and ordinary workmen	2 50 to 3 00

At the mills, when the men are boarded, the foremen get $55 to $60, the latter $45 to $50, per month.

In section 18, page 384, a table is given of the market prices of provisions and various other necessary articles where miners board and lodge themselves.[†]

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[*] Some of these observations originally appeared in newspapers to which they were furnished by the undersigned.—J. R. B.

[†] The prices in San Francisco are from 25 to 30 per cent. less.

Many of the better class build small cabins in the vicinity of the mines, where they can obtain ground free of cost, and live comfortably and economically. This is especially the case where they have families to superintend their domestic affairs. Some of them have thrifty little gardens, and raise all the vegetables they require.

Contrast this with the wages paid at Freiburg, in Saxony, where the miners have as much as they can do to procure the necessary means of subsistence, leaving nothing for the future. Ordinary miners receive per shift of eight hours 8¾ silver groschen, (about 22 cents,) equal to $1 32 per week. Many boys are employed about the reduction works; they earn 1½ to 5 silver groschen for eight hours' labor, equal to 3½ to 11½ cents per shift, or 21 cents to 69 cents per week. The prices of labor in the Harz and in Hungary and Bohemia are nearly the same. It would be difficult to make a comparison of the cost of living in those countries as compared with expenses in the States and Territories of the Pacific slope. If similar articles of subsistence had to be purchased in Europe, the miners there could not earn enough to pay for their food alone. They do not live in the same expensive way, and consequently it costs them a much smaller amount; but the miner in Nevada who receives $4 per day, or $24 per week, and pays $10 per week board, has $14 left, while the Saxon or Harz miner, if it cost him nothing at all to live, would have but $1 32 as the gross result of his labor. The difference in other necessary expenses, such as clothing, &c., bears about the same relation to wages in Nevada, contrasted with wages in Europe, as expenses of living.

I am indebted to Mr. R. W. Raymond, editor of the American Journal of of Mining, for the following particulars in reference to wages paid to miners in Great Britain. At the date of his letter Mr. Raymond was in Boston, and not within reach of all the sources of information familiar to him. It is proper, therefore, that the data herewith submitted should be accompanied by his explanation. He writes under date of October 30, 1867:

> Cut off from my private library, and prevented by circumstances from making thorough research in any of the public libraries of Boston, I cannot give you as full data as I would like concerning the wages paid in England at the present time to miners and mining engineers; but I jot down a few statistics, hastily arranged, on which you may depend as both modern and accurate. If you would pursue your inquiries further, consult "Mineral Statistics of the United Kingdom," Robert Hunt, F. R. S., 1865; reports of the committee of the House of Commons on mines and of the commissioners on mines (parliamentary blue-books, both 1866;) London Mining Journal and Colliery Guardian, 1865, 1866, 1867. The Berg- und-hüttenmänische Zeitung for 1865, 1866, and 1867 contains a series of admirable accounts of coal-mining in England, with some particulars as to wages. This I have used, but the others are at present not at hand; and I have only a few notes from Levi's "Wages of the Working Classes," London, 1867; his authorities are Hunt and the parliamentary reports. Miners are not uncommonly paid (as, for instance, the tributors of Cornwall) according to the amount and quality of ore extracted and its market price at the time; so that they sometimes make large profits and sometimes none at all. In the following table I have arranged the wages per week as well as I could:

Locality.	Mines.	Class.	Shifts.	Wages per week.		
			Hours.	£	s.	d.
Cornwall	Metal	Tributors	8	0	20	0
Do.	do.	Tut-workmen	8	0	18	0
Do.	do.	Surface	12	0	14	0
Do.	Dressing works	Women	12	0	6	0
Do.	do.	Children	12	0	2	6
North of England	Iron	Miners	8	0	22	0
Do.	Dressing works	Separators	12	0	18	0
Do.	Furnaces	Smelters	24	0	20	0
Do.	do.	Roasters	24	0	17	6
Do.	Metal	Miners	8	0	16	6
Wales	do.	do.	8	0	15	0
Newcastle	Coal	Consulting engineer for ten or twelve mines.	....	8–10	00	0
Do.	do.	First manager of each mine.	....	3	00	0

Table of wages, &c.—Continued.

Locality.	Mines.	Class.	Shifts.	Wages per week.		
				£	s.	d.
Newcastle	Coal	Second manager each mine.		2	8	0
Do.	do.	Overmen each mine		0	35	0
Do.	do.	Deputy over-men each mine.		0	28	0
Do.	do.	Miners	7	0	40	0
Do.	do.	Tunnellers	8	0	35	0
Do.	do.	Engine-drivers	12	0	26	0
Do.	do.	Horse-keepers	8	0	16	0
Do.	do.	Boys	12	0	8	0
South Yorkshire	do.	Miners	8	0	24	0
Scotland	do.	do	8	0	24	0
Do.	do.	Surface day laborers		0	16	0
Do.	do.	Superintendent		0	28	0
Do.	do.	Second superintendent		0	25	0
Average of England	do.	Men over 20 years		0	22	0
Do.	do.	Boys under 20 years		0	7	0
Do	Metal	Men over 20 years		0	22	0
Do.	Coal	Boys under 20 years		0	6	0
Average England and Wales	Metallurgical works	Men		0	25	0
Do.	do.	Boys		0	10	0
Do.	do.	Women		0	8	0
Do	do.	Girls		0	5	0
United Kingdom	Iron furnaces, rolling mills, &c.	Men	8-9	0 0	20-40	0
Do.	do.	Boys		0	12	0
Do.	do.	Women		0	10	0
Do.	do.	Girls		0	6	0

N. B.—The averages given, especially in the case of metallurgical works, are made up of widely differing wages, according to rank and skill of workmen. The foregoing table, however, gives a good notion of the condition of the miners and smelters as a class. It will be seen that coal-miners (under contract) often earn more than the salaries of over-men, deputy managers, &c. This is paralleled in Pennsylvania.

The following valuable information in reference to the cost of living in the principal iron districts of England is furnished to the Chicago Tribune by its London correspondent, under date of May 15, 1867. After a detailed statement of the rates of wages, the writer says:

> Referring to the social condition of the workmen earning the wages indicated in the foregoing quotations, I proceed to give the prices of the common articles of consumption, because man's position must be estimated by a comparison between his earnings and the amount which he must of necessity expend in order to support himself and family. The cost of living is not quite uniform throughout the country, but in no district is it higher than in the one selected for illustration.
>
> Retail Prices.—Flour, 2*s*. 8*d*. per 14 pounds, or £1 12*s*. 4*d*. per barrel; butter, 1*s*. to 1*s*. 2*d*. per pound; cheese, 8*d*. to 10*d*. per pound; bacon, 7*d*. to 9*d*. per pound; beef, 7*d*. to 9*d*. per pound; mutton, 6½*d*. to 8½*d*. per pound; pork, 6*d*. to 7*d*. per pound; sugar, 4*d*. to 5*d*. per pound; tea, 2*s*. 6*d*. to 3*s*. per pound; coffee, 1*s*. 2*d*. to 1*s*. 4*d*. per pound; milk, 8*d*. to 1*s*. per gallon; ale, 1*s*. to 2*s*. per gallon; whiskey, 15*s*. per gallon; brandy, 13*s*. to 20*s*. per gallon; gin, 10*s*. to 12*s*. per gallon: gray cotton cloth, 3*d*. to 6½*d*. per yard; white cotton cloth, 4½*d*. to 8½*d*. per yard; loom Dowlas, 7½*d*. to 10½*d*. per yard; white flannel, 1*s*. to 1*s*. 6*d*. per yard; blue flannel, 1*s*. to 6*s*. per yard; colored flannel, 1*s*. to 2*s*. per yard; prints, 5½*d*. to 8½*d*. per yard; French merino, 1*s*. 6*d*. to 3*s*. per yard; Coburgs, 6½*d*. to 1*s*. 2*d*. per yard; Windsey, 6½*d*. to 1*s*. 9*d*. per yard; Linsey, 6½*d*. to 10½*d*. per yard; pilot cloth, 4*s*. 6*d*. to 8*s*. 6*d*. per yard; doeskins, 2*s*. 6*d*. to 5*s*. per yard; moleskin, 1*s*. 6*d*. to 3*s*. per yard; corduroys, 1*s*. 6*d*. to 3*s*. per yard; regattas, 6*d*. to 8*d*. per yard; men's worsted hose, 3½*d*. to 1*s*. 4*d*. per pair; women's cotton hose, 1½*d*. to 1*s*. per pair; bed-ticking, 8½*d*. to 1*s*. 10*d*. per yard; blankets, 8*s*. to 25*s*. per pair; cotton sheets, 2*s*. 6*d*. to 6*s*. per yard; counterpanes, 2*s*. to 6*s*. each.
>
> Ready-made Clothing.—Men's black cloth coats, 17*s*. 6*d*. to 30*s*.; men's black cloth vests, 4*s*. 6*d*. to 9*s*. 6*d*.; men's doeskin trowsers, 10*s*. to 18*s*. 6*d*.; men's coats, mixed goods, 15*s*. to 25*s*.; men's trowsers, mixed goods, 7*s*. 6*d*. to 16*s*. 6*d*.; men's cord and moleskin trowsers, 6*s*. 6*d*. to 8*s*. 6*d*.; men's white duck trowsers, 2*s*. 6*d*. to 4*s*. 6*d*.; men's corduroy and moleskin vests, 4*s*. to 4*s*. 6*d*.; men's corduroy and moleskin jackets, 8*s*. 6*d*.; men's blue pilot-cloth jackets, 9*s*. to 14*s*.; men's heavy flannel jackets, 5*s*. to 8*s*. 6*d*.; men's white duck jackets, 2*s*. 4*d*. to 3*s*.; boots, 12*s*. to 14*s*. per pair; tobacco, 4*s*. per pound.

House rent varies from 2*s*. 6*d*. to 4*s*. 6*d*. per week. Coals of ordinary quality range from 10*s*. to 12*s*. per ton. Rates and taxes will be from 10*s*. to 15*s*. per year. In many cases the houses have small gardens attached, and the occupiers keep a pig. School fees are generally not more than 2*d*. or 3*d*. per head per week. A few pence per week secures the benefit of relief in sickness and medical attendance.

The iron trade is particularly an industry which is conducted on the piece-work and contract system. The masters let the different classes of work to contractors, who employ the requisite number of hands under them, and, as a matter of course, get the labor done as cheaply as possible, in order that the margin of profit may be the greater for themselves. Hence, although the prices paid by any two masters may be nearly identical throughout the mills and forges, it by no means follows that the net earnings of the contractors under each firm will be identical. Boys are employed in the lighter kinds of work, such as door drawing and dragging out iron from rolls, but there are very few employed under 12 years of age.

The same writer adds:

It has been said that the English manufacturers live by pauper laborers, which implies that the operatives are paid starvation prices—barely enough, under the most favorable conditions, to enable them to live, and that when a depression in trade occurs the workmen are thrown upon the union. This is a gross misrepresentation. Any one who would take the trouble to make a close acquaintance with the social condition and habits of the workmen in any of the principal seats of English manufacture—iron, cotton, woollen, or earthenware—would find that, as a rule, work is only carried on five days a week; that the operatives have a keen appreciation of and an ability to purchase the good things of this life; that they are enthusiastic pleasure seekers, and are lavish in their expenses in holiday times; that the more provident are able to invest large sums in building societies, post office savings banks, and the like; that many of the men live in their own houses, and a greater number have very respectable and well-furnished houses. Unfortunately, high wages too frequently begets extreme indulgence and improvidence, and there are many dark spots in the social life of any district; but this is the fault of the individuals themselves, and were they willing they might speedily improve their circumstances.

WAGES GENERALLY AND DEMAND FOR LABOR.—The following is a copy of an address from the Mechanics' State Council of California to the mechanics of the United States and Europe:

A copy of a circular is in our possession, which we are informed is being distributed throughout the Atlantic States and Europe by the authority of the Pacific Mail Steamship Company, which bears upon one side of a half sheet the advertisement of that company's California line, and on the other what purports to be a correct list of the wages paid for the various classes of labor in this city and State. This list is accredited to the Alta Californian, the organ of the capitalists and monopolists of this coast, and which has ever been the enemy of labor and labor interests. It was published for the purpose of inducing an undue immigration to this State, especially of mechanics, expecting by that means to break down the trade associations in existence here, particularly those which have adopted the eight-hour system. This, too, is one of the objects of the Pacific Mail Steamship Company in republishing it in the manner they have. They have threatened to bring large numbers of mechanics here, let it cost what it may.

They have already brought from 40 to 60 here under contracts to work out their passage after their arrival. The conditions of these contracts are all in favor of the company, they not having bound themselves to give the men work except at pleasure. Some of those who came here under these contracts are now out of employment, and have demanded that they be employed or that a return ticket be furnished them, both of which demands were refused. A breach of the peace was the consequence, in which the agents of the company were the victors. It is a fact well known to the agents of the various steamship lines having vessels running to and from this port, that there is already an excess of workmen in all the ship-working trades here, and has been for years. They know, too, that in consequence of this excess the workmen are idle nearly, if not quite, one-half of their time. They know, too, that the sum of $9 per day, quoted as the wages paid to caulkers, is not, nor has it ever been, the current wages here for ten years past; and that $15 per day for Sunday's work was never paid but in a single instance. Both these prices were paid by a steamship company to obtain men to prepare a ship for sea, on one occasion, two years ago—the men working extra hours to get her ready to sail as advertised. The shipwrights, ship-joiners, caulkers, bricklayers, stonecutters, and some one or two other trade associations, regulate wages and have uniform rates. In other branches each journeyman contracts for himself. "The Mechanics' State Council," a central organization, composed of delegates from the various trade associations, have appointed a committee to ascertain and report to them, among other things, the rate of wages paid to journeymen in all branches, with the average amount of time employed during the year. This committee have not yet completed their reports, but they have furnished us the following statistics concerning some of the principal trades:

Trades.	Highest wages per day.	Average.	Trades.	Highest wages per day.	Average.
Shipwrights	$4 00	$2 81	Plumbers	$3 00 to 4 00	$2 75
Ship-joiners	4 50 to 6 00	2 75	Gas-fitters	3 00 to 4 00	2 75
Caulkers	3 00	2 50	Machinists	2 50 to 4 00	2 75
House carpenters	2 50 to 4 00	2 25	Wood-turners	3 00 to 4 00	3 00
Painters	3 00 to 4 00	2 25	Scroll-sawyers	3 50 to 4 00	2 50
Bricklayers	5 00	2 75	Stevedores	5 00	2 50
Plasterers	4 00 to 5 00	2 50	Riggers	4 00	2 50
Stone-cutters	4 00 to 5 00	3 00	Lathers	3 00	2 00
Blacksmiths	3 00 to 4 00	3 25	Pattern-makers	3 50 to 4 00	2 50
Boiler-makers	3 50 to 4 00	2 50	Moulders	4 00	2 50

These figures were obtained by consulting the members of the various trades, and can be relied upon as correct. We are led to believe that an organization consisting of 30 or 40 of our citizens, and known as the "Immigrant Aid Association," is aiding in the dissemination of statements which are calculated to deceive the unwary. Therefore we say to all, receive any statements relating to the rate of wages, the chance and prospects for obtaining good arable lands near the market, or to there being a demand for skilled labor here, with many grains of allowance. They are but an *ignis fatuus*, intended to allure you here to accomplish some private purpose of individuals or monopolies. Times are dull here in many trades, and they cannot be expected to improve while the rainy season lasts. In some trades the approach of wet weather tends to improve business; among these are the metal roofers, asphaltum workers, and shoemakers. For the first time in the history of this city, relief committees to provide for the necessities of the members of several of the trades have been formed, and hundreds of dollars have been collected and disbursed for this purpose. Let no one come here without the means of support in case they fail in getting employment. To mechanics, of all trades, we say, if you come here with good feeling toward your fellows, with the intention of working hand in hand with us in support of the interests of the working classes, we will extend you the right hand of fellowship and welcome you as brothers. But do not come here, as some have already done, in the interest of capital, to assist in crushing the labor interest of this coast. Any information regarding any trade can be obtained by addressing the "Mechanics' State Council," box No. 1493, San Francisco, or to either of the undersigned at the same post-office.

By order of the Mechanics' State Council of California, San Francisco.

H. J. LOASSE,
A. M. GREY,
CHAS. C. TERRILL,
Corresponding Committee.

SAN FRANCISCO, *November* 25, 1867.

Commenting upon the address above quoted, the Alta California says:

The document is a very singular one, and seems to have excited a good deal of surprise at the east, where it did more to open the eyes of workingmen to the gross folly and injustice of Trades Unions seeking to monopolize employments in a few hands at high wages than almost any argument could have done. There are thousands of industrious workingmen at the east and in Europe, who at this time are unable to obtain work at all. Those who can get employment receive $1 50 to $2 in greenbacks—say $1 to $1 50 (and average for the year $1 for ten hours' work) in gold. Flour is $10 gold per barrel, and other provisions and expenses of living in proportion. Those people struggling for life have put into their hands the address to which we called attention.

That address informs them, on the authority of the State council, that wages in 20 mechanical branches, which it enumerates, average $2 55 in gold throughout the year for eight hours' work. They know that flour and provisions here are cheaper than there, since they are sent hence at a profit. They know while the price of fuel there has risen, as the thermometer falls to zero, to rates which absorb their whole earnings, that this climate nearly dispenses with that expense. They know that the amount of labor to be done here in developing the natural wealth of the coast is limitless, and that the more there is done the more capital will increase to employ still more. They know also that passages are so low now that the transit may be made for the wages of two weeks' labor here. Three weeks will transport them from cold and idleness and hunger to warmth, abundance, and high wages. Having a lively sense of these truths impressed upon them by the circumstances of distress which surrounds them, they reflect upon the true import of passages like the following in "the address:"

"It (rates of wages) was published for the purpose of inducing an undue immigration to this State, especially of mechanics, expecting by that means to break down the trade associations in existence here, particularly those which have adopted the eight-hour system."

"The shipwrights, ship-joiners, caulkers, bricklayers, stone-cutters, and some one or two other trade associations, regulate wages, and have uniform rates. In other branches each journeymen contracts for himself."

"Let no one come here without the means of support, in case they fail in getting employment. To mechanics of all trades, we say, if you come here with good feeling toward your fellows, with the intention of working hand in hand with us in support of the interests of the working classes, we will extend you the right hand of fellowship, and welcome you as brothers. But do not come here, as some have already done, in the interest of capital, to assist in crushing the labor interest of this coast."

These contain the whole programme. The rates of wages are so high here that very little work can be done locally, none that can be possibly avoided. This is seen in the fact that imports of goods made elsewhere increase enormously. The evidence of this is in the returns of duties, which for the first two months of this year were $1,419,089, against $1,181,427 last year, an increase of 25 per cent. This increase of importations has taken place since the eight-hour law was insisted upon, and as a consequence the address states:

"Times are dull here in many trades. * * * * For the first time in the history of this city, relief committees to provide for the necessities of the members of several of the trades have been formed, and hundreds of dollars have been collected and disbursed for this purpose."

The stranger may ask, if, as the address asserts, wages are $2 50, gold, per day, how is it that so many persons are to be relieved? Why will they not take less rather than turn paupers? The paragraphs cited give the reply. The trades unions "regulate wages," and suffer no work to be done but at their prices. If those are so high that employers are compelled to import the goods instead of making them, and discharge the hands, those still in employ are assessed to give charity to those discharged. So arrogant are these unions, that not long since many scores of men in one shop struck work because a boy had used a hammer for a short time upon some work. What is called "undue immigration," is the arrival of any person not a member of the union, who seeks work for any employer who will pay him. The right of a man in possession of capital to employ a man to do some work for him, without asking permission of the union, is utterly denied. Also, the right of a man to work for wages without the sanction of "the council" is sought to be abolished. Hence the address says, if they come here to obey the council, "come," and get work if you can, but not otherwise. The covert threat contained in the advice not to come "in the interests of capital" may be taken for what it is worth. This sort of "dictatorship" in a country where slavery was supposed to be abolished is a marvel. The extent to which this system may be pushed is made painfully manifest in the horrors brought to light in England through investigation into operations of trades unions. Happily, here we may rely on the good sense of the people at large, who understand that the true interests of this coast can be served only by carrying out the principles of our institutions, which guarantee freedom to every man in the "pursuit of happiness."

When the eastern mechanics see that a close monopoly of unions here enjoying $2 50, gold, per man, for 10 hours' work, not being satisfied with that, reduced the hours to eight, thus increasing the actual wages paid by employers to $3 10, gold, and then coolly notify "the mechanics of the United States and Europe" not to come here and disturb their "good thing," it is possible they may consider their equal rights under the law as good as those of "the council," and conclude that if capital enable them to earn even $2 per day, gold, here instead of $1 at home, then the "interests of capital" are worth considering.

An analysis of the data contained in the preceding pages of this report will show the following results:

1. That the area of territory west of the Rocky mountains, abounding in the precious metals, and in the useful minerals, is limited only by the geographical boundaries of our possessions.

2. That of the vast number of valuable mineral-bearing lodes known to exist in our Pacific States and Territories, but an infintesimal proportion is in actual process of development.

3. That the area of lands suitable for cultivation is sufficient to support a population greater than the total present population of the United States.

4. That with a climate so salubrious, and resources so varied, this region offers inducements to immigration unsurpassed by any other part of the world.

The following table shows the area and population of each State and Territory, the number of miners actually at work in the mines, and the product of bullion for 1867. In estimating the population engaged in mining, it is difficult to fix upon an exact limit. Mechanics who make the machinery, or put it up in the mines; teamsters who haul the ores or the supplies; assayers, metalurgists, and other incidental experts and employés, are to a certain extent engaged in the business of mining. Many thousands who never see a mine derive their support from this interest. If we go beyond the superintendents, experts and operatives directly engaged in working the mines, the field is unlimited, for it may be said the whole population on the Pacific coast is interested directly or indirectly in this pursuit:

Area, population, and product.

States and territories west of the Rocky mountains.	Area—square miles.*	Acres.	Estimated population in '67.	No. of men actually working in mines.	Product of gold and silver for the year ending Dec. 31, '67
California	188,981	120,947,840	488,000	25,000	$25,000,000
Nevada	112,090	71,737,741	36,000	10,000	20,000,000
Arizona	113,916	72,906,304	3,000	500	500,000
Utah	88,056	56,355,635	110,000	200	....
Montana	143,776	92,016,640	32,000	8,000	12,000,000
Idaho	90,932	58,196,480	20,000	6,000	6,500,000
Washington Territory	69,994	44,796,160	13,000	1,300	1,000,000
Oregon	95,274	60,975,360	78,000	1,000	2,000,000
Total	903,019	577,932,160	780,000	52,000	67,000,000
Add for total product of the United States:					
New Mexico				$500,000	
Colorado				2,500,000	
All other sources				5,000,000	
					8,000,000
Total					75,000,000

* According to report of Commissioner of the General Land office.

The above table shows that with an area of 903,019 square miles we have a population of only 780,000, less than one to the square mile. According to the eighth census (1860) the New England States have 49.55; the middle States 69.83; the southern coast States 15.25; the western central States 20.93; the northwestern States 22.14; Texas 2.55. Mr. De Bow, in his compendium of the seventh census, gives the density of population in Europe and other foreign countries as follows: Russia in Europe 28.44; Austria 141.88; France 172.74; England 332.00; Great Britain and Ireland 225.19; Prussia 151.32; Spain 78.03; Turkey in Europe 73.60; Sweden and Norway 15.83; Belgium 388.60; Portugal 95.14; Holland 259.31; Denmark 101.92; Switzerland 160.05; Greece 55.70; Mexico 7.37; Central America 10.07, &c.

It will be seen that while the population in the Pacific States and Territories is less than one to the square mile, some of the countries of Europe exceed 300, as, for example, England 332.00; Belgium 388.60. This simple statement shows conclusively the great desideratum of the Pacific coast. We have climate and natural resources equal to those of the Atlantic States and superior to any in Europe; we have land enough for the support of millions of laborers where we now have only thousands. We want population. Cheap labor will develop the dormant wealth of the country. To insure this we need the speedy completion of the Central Pacific railroad, and the prompt construction of the two additional lines projected across our continent, one north and the other south. It is absurd to say, with such a variety of undeveloped resources as we possess, that employment is difficult to obtain, and no demand exists for labor. If we require no labor, there can be no demand for population; and if we need no increase of population, then all progress must be considered prejudicial to the interests of the country. The Commercial Herald and Market Review, of San Francisco, judiciously remarks:

> The recent numerous arrivals of immigrants from the east and from Australia foreshadow the great rush which will undoubtedly be made in this direction during the current year, and it is eminently proper that these strangers should be instructed by competent parties how to

employ themselves with profit. An army of consumers, who are non-producers, cannot long exist in that condition without means, and in this case our visitors are not overburdened with cash. They cannot all find occupation in farming; nor are our manufactories sufficiently extensive to accommodate any large number of them; but our placer mines are far from being exhausted, and still offer a lucrative field for the operations of industrious and sober men. The cost of living has been reduced three or four hundred per cent. since 1852, and, although the placer mines do not yield so richly as at that period and before, they are still capable of returning better wages to the industrious miner than he can obtain in any other State of the Union. Formerly five dollars, or even seven dollars, a day would not pay a man for his time and labor, because the rates of living were too high; and many fields were abandoned which are still capable of yielding those daily returns. Now, a sober, economical, and industrious miner can support himself handsomely and save money on $2 per day.

The heavy floods of last winter have probably unearthed much wealth in our gulches and other placer diggings. The copious rains of 1861-'62 certainly had that effect, and new discoveries of a rich character were made at that period. Opportunities for reaching the mines are now plentiful where none formerly existed. Mining tools are abundant and cheap in comparison with the prices ruling 10 or 12 years ago. It is then our earnest advice to those newly arrived immigrants to furnish themselves with picks, hoes, and shovels, without delay; take the earliest opportunity to leave the city and seek the placer diggings; go to work with will and determination; stick to it with resolution, and but few years will elapse before they will thank us for the advice, and congratulate themselves for having acted upon it. The longer they remain "waiting for something to turn up," the deeper will they sink into the slough of despondency, and the less heart will they have for resolute and determined action. Our placer mines still offer a remunerative field for industry. They are not "worked out," nor impoverished to an extent that will not pay wages to the miner. Many of them will yield from $2 to $4 a day to the hand. Of this there is no doubt, and if newly arrived immigrants with limited means will only accept the offers held out by these mines, they will do wisely.

On the same subject the San Francisco Evening Bulletin makes the following timely and sensible remarks:

Immigration in 1849 and 1868.—The pioneer immigrants of 20 years ago endured hardships of which the immigrants of this year will know very little. The six months' voyage around Cape Horn in crowded ships, badly provisioned, or the bungalow passage up the Chagres river, and the mule ride into Panama, with the long waiting on the Isthmus, or the still longer overland journey—these are experiences of which the modern immigrant will know little or nothing. The men of '49 found nothing which could be called homes. A sand spit, with a few board and cloth houses, gave little promise of the future city. Every article of food or clothing was enormously high. It cost nearly as much to reach the mines from this place as the immigrant is now charged for a passage from Southampton to this port. The Senator, a year later, transported passengers from this city to Sacramento at rates varying from $30 to $35 each, and on reaching the latter place the rough and costly journey was but just begun. If the miner was successful, his gains would secure very few comforts, for they were not in the country. If he fell sick, the misfortune was aggravated by exposure and the absence of all the comforts and appliances which increased the chances of recovery. There were both suffering and heroism, and as brave struggles with an adverse fate as was ever known in the history of any country.

The immigrants of 1868 will assume no such risks as did these pioneers. They will come to a country already dotted over with homes, even more attractive than those of earlier days. There are cities, towns, schools, churches, highways, vineyards, orchards, and farms, while the cost of living has been reduced below the prevailing rates in many of the Atlantic States. And with all these advantages the chances of success in any industrial calling have hardly been reduced at all. Wages are not so high, but the cost of living has been cheapened more than the cost of labor. The advantages of permanent prosperity, upon the whole, appear to be upon the side of the immigrant of 1868. It is a more auspicious time to begin the struggle for a foothold and for a competence than it was 20 years ago. The few great opportunities for sudden fortunes may not be so apparent, neither are the risks of failure so great.

No doubt, immigrants who land here during the present year without money will suffer many hardships and privations. Some will belong to the great army of incapables, others will suffer from diseases incident to changes of country and climate. Many will come with more hope than resources, either of capital or muscle. But the immigrants of the present year are not likely to incur greater risks of privation than will those who land at New York. Of the 50,000, more or less, who may come to the State during the present year, probably one-half will come from the States east of the mountains. A large number of them have friends here, by whose advice or through whose information they exchange an old home for a new one. This element of incoming population will need very little help. Very few of them will want charity soups or free lodgings. With a little margin of ready cash they will strike out for themselves and help to make their own opportunities. The immigration from

European countries will be more likely to need aid. The country will be new and strange to them, and there will not always be that ready adaptation to the exigencies of new positions. Taking the most favorable view of this incoming population, it will still be true that a good work can be done in alleviating incidental cases of distress and in preventing others, by furnishing to the immigrant without cost such information as will insure his employment with the least possible delay.

The Sacramento Union, in an article advocating the organization of a proposed "labor exchange," makes the following judicious suggestions:

> **How to aid Immigrants.**—A preliminary meeting was held at the Merchants' Exchange in San Francisco, on Tuesday evening, to organize a "labor exchange," or a society to devise means for securing employment and present subsistence for needy immigrants arriving in that city. The idea is an excellent one and well timed. The society should be organized without delay, and we hope to see it embrace a large number of the best men and most practical minds in the State.
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> Many will arrive penniless. Nearly all will be landed at San Francisco. Without some means they cannot leave there for any part of the State where the market for labor calls them. It will be necessary that the city shall take present care of the needy. Alms-houses are not to be thought of in this connection. The desideratum can only be reached through a society having the hearty patronage of every business department and the use of large sums of money to feed the immigrants and forward them to employment in the interior. Such a society ought to embrace members of the large corporations of the State—railway companies, steam navigation company, the chamber of commerce, the supervisors, and the mayor of San Francisco. It could, with such a make-up, very soon enlist the good offices of the press, and the accord of the people of the interior. These immigrants are coming here because we have repeatedly given out that they are greatly needed, and that we have an abundance of work for them. These inducements were held out in good faith. We do need them, we have work for them. But it is sure to happen here, as everywhere else, that any extraordinary influx of population will occasion some distress. How to get along with the least distress is the problem to be solved. We would suggest that the San Francisco "labor exchange" organize at once, and enlist in its ranks as many of the practical business men of that city as possible. Let them then put the society in communication with the leading business men of the interior, who are posted as to the probable demand for fresh laborers in their respective districts. The several railway superintendents could tell them within a score or two how many they can employ each month, and how many to forward. The immigrants might be forwarded at the expense of the society, who could arrange in a business way to be repaid by the interior employers from the first month's wages earned. The great grain shippers of San Francisco have their purchasing and forwarding agents in every grain region of the State. These are, no doubt, well posted as to the increased number of hands the present crop will require in harvesting. Let the society put itself in direct communication with these agents, and here will be an opening for hardly less than 10,000 men at from $50 to $60 per month for not less than two or three months. By the same general system other thousands might be employed in the timber and lumber regions, and in the considerable improvements that will be made this season in all the towns and cities of the agricultural districts. It is not probable that more than a third of the new-comers will require any other aid than such valuable information as a society so organized might be able to give as to the best means of reaching this, that, or another point in the interior, the quality of its soil, climate, price of land, advantages of cultivating and means of marketing produce. Doubtless many who come will have the ready means to go to work for themselves and become employers of others who are destitute. Of the 50,000 who may be expected, 10,000 to 15,000 are likely to need more substantial aid to start them off in a way to earn a subsistence. There is room for all and more than these on the railways in course of construction and in gathering a harvest nearly twice as great in area as any ever before planted in the State.

SECTION II.

GENERAL CONSIDERATIONS ON THE PRECIOUS METALS.

Why Gold and Silver are used for Money.—Gold and silver were adopted as standards of value long before the beginning of the historical era; and their fitness for money was evident even to barbarians. They are hard and not subject to oxidation, and therefore they can be kept and handled with comparatively little loss. They have a brilliant lustre suitable for articles of ornament; and the peculiarity of the lustre, color, and high specific gravity renders them easily distinguishable from other substances, and makes imitations difficult. They are fusible and malleable, so that they can be made into any form or stamped with any impression, and the hardness will protect the form or impression from wearing out. Both metals are found pure, so that savages would become accustomed to their use before learning to smelt the ores of iron, copper, and lead. Both metals are rare, and thus a small quantity has served to represent a large value of other articles; and wealth in the form of gold and silver could readily be concealed, or transported from one country to another. There are other hard, rare, and lustrous metals, but they cannot readily be refined, or their lustre is not peculiar, or the supply is not regular, or they have no recognized value in the arts; and thus gold and silver are to-day, as they were 5,000 years ago, the best of all metals for the purposes of money.

The Quantity of the Precious Metals in Greece and Rome.—The quantity of precious metals was small when Athens began to throw the brilliancy of her intelligence and genius over the ancient world. About the year 600, B. C., nine bushels of wheat could be bought for an ounce of silver in Greece; or, in other words, a bushel of wheat cost 15 cents of our money. The advance of civilization was accompanied by an increased production of gold and silver. There were mines of both metals in Egypt, Thrace, Armenia, Spain, and the dominions of Attica. Spain had the richest mines, and the placers in the Asturias produced $4,000,000 annually for a time, and a silver mine at Guadalcañal yielded 300 pounds of metal daily. The spoils of Persia added greatly to the stock of the precious metals in Greece, and after the death of Alexander an ounce of silver would buy only three bushels of wheat, or only one-third as much as three centuries earlier.

In Italy, previous to the first Punic war, gold and silver were still very scarce and high in price, but when "the senate and people of Rome" became masters of the world, wealth poured in upon them from all the borders of the Mediterranean, and the bushel of wheat which cost the twentieth of an ounce of silver 350 B. C. cost an ounce and a third in the middle of the first century.

The annual revenue of the empire in the time of Augustus was $200,000,000, and that emperor received $150,000,000 in legacies from his friends.

Cicero received $800,000 in fees, a sum which has probably never been paid to any modern lawyer.

C. C. Isidorus, besides large estates and 4,000 slaves, had $15,000,000 coin at the time of his death, calculating the value of the money according to weight. Jacobs estimates the total stock of coin in the Roman empire in 40 A. D. at $1,750,000,000.

The Principal Epochs in the Modern Production of the Precious Metals.—As civilization declined, the quantity of the precious metals decreased, and Alaric consented to spare Rome for $1,500,000, and 40 years later the Eternal City had some difficulty in raising $1,200,000 to buy off Attila. The annual average wear of coin is estimated at about one part in 360; and when this continues for centuries with no new supply it makes a great reduction. According to the estimate of Jacobs there were in 1492 only $170,000,000 of the precious metals in Christendom. Previous to the conquest of Mexico the new world yielded only about a quarter of a million dollars annually to Spain, the government of which lost considerably by the discovery, until Cortes succeeded in overthrowing the empire of the Montezumas.

The Aztecs washed gold from the placers and smelted silver from the ores, and had a considerable stock of precious metals on hand when Cortes came. He of course took all he could get, and he and his associates soon commenced the working of the lodes known to his subjects. Among these were Tasco, Zultepec, Tlalpujahua, and Pachuca, all in the vicinity of the capital. The annual shipment to Spain from 1519 to 1545 was $3,150,000. In the latter year the mines of Potosi were discovered, and their yield was so great for that age that a wonderful impulse was given to mining industry throughout the new world. In 1548 Zacatecas began to produce its treasures; Sombrerete in 1555, and Guanájuato in 1558. In 1557 a miner named Bartolome de Medina, working Pachuca, made a discovery that was more important to silver mining than even the opening of Potosi. He found that silver could be extracted from the common ores by mixing the pulverized mineral with water, salt, and copper pyrites, and it was a process that required very little water, no fuel, little machinery, no mechanical skill, and few buildings. It was a method of reduction peculiarly adapted to the treeless and waterless mountains, and to the ignorant mining population of Mexico and Peru. Previously all the silver had been obtained by smelting, in a very expensive and wasteful manner, the furnaces being small and very numerous; so that it was impossible to prevent great loss, both by incompetency and by dishonesty.

Some years elapsed before the amalgamation process was extensively adopted, but within 10 years it had been introduced into all the mining districts of Spanish America; and the workmen became expert, and as the mine-owners found the separation of the metal on a large scale could be supervised by one or two men, and that thus waste and thieving could be prevented to a much greater extent than before, they made renewed exertions to extend their works. The production of Potosi was six times as great in 1585 as it had been 12 years before, owing partly to the general use of amalgamation, which was first introduced there in 1570, and was not generally accepted until some years later. The copper-pan or cazo amalgamation was discovered in 1590, at Potosi, by Alonzo Barba, but its use was confined to a few districts. It was during the last decennium of the 16th century that Potosi was in its most prosperous condition, producing $7,500,000 per annum.

In 1630 the mines of Cerro Pasco were discovered.

In the years 1726 and 1727 the Vizcaina and Jacal mines of Zacatecas yielded $4,500,000.

The great bonanza of Real del Monte was opened in 1762, yielding $15,000,000 in 22 years.

The great wealth of the Veta Madre was demonstrated in 1768, and Guanajuato rose almost to the leading position among the argentiferous districts.

The production of silver in Mexico increased very rapidly from 1770 until the beginning of the revolution; and the increase was owing to various causes, including the reduction of the royal tax from 20 to 10 per cent. on the gross yield, the reduction in the price of quicksilver, the opening of commerce to Spain, merchant vessels from numerous ports instead of confining the trade to vessels from only two ports, the reduction of the price of blasting powder from 75 to 50 cents per pound, the abolition of the alcabala, an article needed at the mines, (an odious and oppressive tax on internal trade,) and the purchase of bars by the provincial treasury. The fact that the country could produce $10,000,000 annually from 1760 to 1770, as it did, in spite of all these restrictions, furnishes conclusive proof of the wonderful wealth of the mines, and also of the industry of the people. A tax of 20 per cent. on the gross yield would paralyze every branch of British and American mining, and would entirely stop the production of the precious metals in many districts of California and Australia. Quicksilver, of which more than a pound was lost for every pound of silver extracted, cost 80 cents per pound in 1750, and was reduced in 1767 to 62 cents, and in 1777 to 41 cents. The purchase of bars by the provincial treasuries was of great benefit to the miners, who previously had to sell their bullion at a loss of 20, 30, or in remote districts even 40 per cent. There were few merchants, and those few expected to make great profits from their transactions.

The mines of Hualgayo in Peru were found in 1771, and three years later the placers of the Ural, which were known in the time of Herodotus, were rediscovered.

It was estimated in 1777 that two-fifths of the silver of Mexico was obtained by smelting, but this was probably an exaggeration, and when Humboldt was in the country only one-seventh was taken out by means of fire.

The mines of Catorce were opened in 1778, and proved to be very rich, the mine of Padre Flores yielding $1,600,000 the first year.

The mines of Guarisamey, near Durango, became productive in 1783.

For two centuries the pulp in the yard amalgamation process, made with pulverized ore, quicksilver, salt, pyrites, and water, was mixed by the treading of men, who, notwithstanding the cold, moisture, and mercury, were generally healthy.

Singular as it may seem, it was not till 1783 that mules and horses were introduced to this work; and, although the change saved 75 per cent. of the expense on that branch of the working, still it would probably not have been adopted when it was, but for the greatly increased production of silver in Mexico, and the difficulty of getting Indian *repasadores* in some districts.

The great bonanza of Ramos, that yielded $18,000,000 in nine years, was opened in 1798.

The mines of Mexico continued to increase in productiveness until the revolution, which was a war of races, the Mexicans against the Spaniards, the latter being in a small minority, but possessing most of the wealth, mining and commercial knowledge and enterprise in the country. They were driven out, and with them went three-fourths of the men who had the money and brains to conduct large mining operations. The production fell from $22,000,000 to less than one-third that amount, but it soon began to increase again, and from 1850 to 1860 it was as large as from 1795 to 1805.

When the independence of Mexico was recognized and peace was restored, it was expected that the production would soon rise far beyond its former figure. The most brilliant hopes were excited in England, and they were based on many plausible considerations, but they were destined to bitter disappointment.

Many of the best mines were offered for sale for about the amount which they produced annually. They had been well opened; their value had been proved; they had been abandoned while in full production, with large bodies of rich ore in sight; some of them had not suffered much by standing idle; their production had been increased at the average rate of three per cent. annually for 40 years before the revolution, and the workmen familiar with all the processes of mining and reduction were still numerous. And if such production and increase occurred under the oppressive policy of the Spanish government, and under the ignorant management of the Spanish mine owners, what might not be expected under a liberal republic and English engineering? The mines would no longer be burdened with the payment of one-tenth of the gross yield, over and above all the costs of refining and coining. The ore would no longer be carried up to the surface from depths of 1,500 or 2,000 feet on the backs of Indians, nor would it be packed 6, 10, or 20 miles on mules to the reduction works, nor would the water be hoisted up in raw-hide buckets by horse whims, nor would mules and horses drive the arrastras and stamps. Steam would pump the water, hoist the ore, and drive the pulverizing machinery. Wagons would do the transportation. Skilful engineers would direct the cutting of adits, shafts, and working levels, and educated metallurgists would have charge of the amalgamation. The production should rise to $50,000,000 or $100,000,000 a year, and those companies which could get possession of the best mines should make princely fortunes for all their shareholders. Great care should be exercised in the purchase of the property; only those mines should be bought which had been visited by Humboldt in 1803, and were mentioned in his book, and were known to have continued productive up to the revolution. On these principles, it was supposed that failure would be impossible. But failure was possible, and it came. England during the silver fever spent $50,000,000, for which she got little return save dear experience. Independence did not prove a great blessing to Mexico. Peace never came, and without peace there could be no success, for silver mining above all other pursuits demands peace. Forced loans were levied by the government on the productive mines, and the silver bars while on the way to the coast were taken by highway robbers. The steam machinery could not be taken to the mines till roads had been made and wagons imported; the roads cost immense sums; when the engines were in place native engineers could not be found, and foreign engineers were murdered; English superintendents and Mexican miners could not get along together; the mines were found in a much worse condition than that in which they were at the time of sale represented to be; and in a few years the mines of Mexico were, with a few exceptions, abandoned to the Mexicans.

The most notable mining districts opened in the 19th century have been the placer district of San Francisco in Sonora, in 1803; the Melkowka placers in Siberia, in 1816; the silver district of Fresuillo, in 1824; the silver district of Chañarcillo, Chili, in 1832; the silver district of Guadalupe y Caloo, in 1834; the silver district of Guadalcañal, in Spain, about 1830; the placers of the Altai mountains, in Siberia, in 1830; the placers of the Sacramento basin, in 1849; the placers of Australia, in 1851; the placers of New Zealand, in 1857; the placers of British Columbia, in 1858; the placers of Colorado, in 1859; the silver district of Washoe, in 1859; the Nevada iron pan amalgamation, in 1860; the silver and gold of Idaho, in 1861; the placers of Montana, in 1862.

Stock of Precious Metals.—The stock of coin in Christendom in 1492, and at various epochs since, may be thus estimated:

Stock of gold and silver coin in Europe in 1492			$170,000 000
Production of 108 years, less loss by wear		$690,000,000	
Used in arts	$140,000,000		
Sent to Asia	70,000,000		
Deductions		210,000,000	
Net gain from 1492 to 1600			480,000,000
Stock at end of 1600			650,000,000
Production of the XVIIth century		1,687,000,000	
Sent to Asia	165,000,000		
Used in the arts	300,000,000		
Abrasion and loss	385,000,000		
Deductions for the XVIIth century		850,000,000	
Net gain of the XVIIth century			837,000,000
Stock at end of 1700			1,487,000,000
Production of the XVIIIth century		4,000,000,000	
Sent to Asia	400,000,000		
Used in the arts	800,000,000		
Wear and loss	600,000,000		
Total deductions for XVIIIth century		1,800,000,000	
Net gain of XVIIIth century			2,200,000,000
Stock at end of 1800			3,687,000,000
Production of 1st quarter XIXth century		750,000,000	
Wear and loss	175,000,000		
Used in the arts	200,000,000		
Sent to Asia	125,000,000		
Deductions for 1st quarter XIXth century		500,000,000	
Net gain of 1st quarter XIXth century			250.000,000
Stock at end of 1825			3,937,000,000
Production 2d quarter XIXth century		1,200,000,000	
Wear and loss	200,000,000		
Used in the arts	350,000,000		
Sent to Asia	175,000,000		
Deductions 2d quarter XIXth century		725,000,000	
Net gain 2d quarter XIXth century			475,000,000

Stock at end of 1850			$4,412,000,000
Production from 1851 to 1866, inclusive		$2,500,000,000	
Wear and loss	$250,000,000		
Used in the arts	500,000,000		
Sent to Asia	800,000,000		
Total deductions for 16 years		1,750,000,000	
Net gain from 1851 to 1866			750,000,000
Stock at end of 1866			5,162,000,000

The following is Jacobs's estimate, as given in Vol. II, pp. 70, 131, 214, and 322:

Stock on hand in 1492			£34,000,000
Production 1493–1599 over loss and wear		£138,000,000	
Used in the arts	£28,000,000		
Sent to Asia	14,000,000		
Total deductions 1493–1599		42,000,000	
Net gain 1493–1599			96,000,000
Stock on hand at the end of 1599			130,000,000
Productions of XVIIth century		337,500,000	
Sent to Asia	32,250,000		
Used in the arts	60,250,000		
Wear and loss	77,000,000		
Total deduction for XVIIth century		170,500,000	
Net gain of XVIIth century			167,000,000
Stock on hand at the end of 1699			297,000,000
Production of 1700 to 1809		880,000,000	
Sent to Asia	352,000,000		
Used in the arts	352,000,000		
Wear and loss	93,000,000		
Total deductions 1700 to 1809		797,000,000	
Net gain from 1700 to 1809			83,000,000
Stock on hand at end of 1809			380,000,000
Production from 1810 to 1829		103,736,000	
Sent to Asia	40,000,000		
Used in the arts	112,252,220		
Wear and loss	18,095,220		
Total deductions from 1810 to 1829		170,343,440	
Decrease from 1810 to 1829			66,611,440
Stock on hand at end of 1829			313,388,560

It has been customary to make estimates of the amount of precious metals in Christendom at various times by deducting the quantity shipped to China and Hindostan, and the quantity used for plate; but there is a constant change from coin to plate and from plate to coin, and the wide line which once separated China and Hindostan from European trade has now disappeared, and those Asiatic countries are within the pale of civilized commerce, and are almost as near to London and New York as California and Victoria.

Whitney, in his Metallic Wealth of the United States, says that in 1853 the Russian empire produced 64,000 pounds Troy of gold; Austria, 5,700; the remainder of Europe, 100; Southern Asia, 25,000; Africa, 4,000; South America, 34,000; and the United States, (exclusive of California,) 2,200.

The gold production of Chili in 1845 (the statistics for later years not being obtainable at the time) was 2,850 pounds Troy; of Bolivia, 1,200; of Peru, 1,900; of New Grenada, 13,300; of Brazil, 5,100; and of Mexico, 9,900.

The yield of silver in 1850 is thus stated:

Russian Empire, 60,000 pounds Troy; Scandinavia, 20,400; Great Britain, 48,500; Harz Silver District, 31,500; Prussia, 21,200; Saxony, 63,600; other German states, 2,500; Austria, 87,000; Spain, 125,000; France, 5,000; Australia, 10,000; Chili, 238,500; Bolivia, 130,000; Peru, 303,150; New Grenada, 13,000; Brazil, 675; Mexico, 1,650,000; California, 17,400; total, 2,817,425 pounds Troy.

The Drain of Silver to Asia.—It is admitted by all eminent authors who have written about the present supply of the precious metal that it far exceeds the demands of Christendom, and that the inevitable fall in value is retarded only by exceptional and temporary circumstances, the chief of which is the remarkable stream of silver pouring into Asia. The Hindoos and Chinese and Japanese are industrious and very populous nations, which have to import nearly all their gold and silver from abroad, and their capacity to absorb those metals increases as value declines, and as their stock becomes greater their wages rise, and they obtain the means to purchase more foreign goods, and after a time they will have as much coin proportionately to their productive powers as the Christian nations; and then their imports of merchandise will nearly equal their exports, and the importation of the precious metals will not be one-tenth of the present figure.

Asia was called "the sink of silver" by Pliny, and it has deserved that name ever since, and will continue to deserve it for an uncertain period in the future. So long as we continue to consume so much tea, silk, sugar, rice, and other Asiatic products, and so long as they consume so few of our products, so long we must settle the difference by payment of the precious metals, and the precious metals will probably not decline much in value. But let the vessel of Asiatic trade, now half empty of silver, be once filled, as it will be in 5, 10, or 15 years, and then we shall begin to feel the influence of the over-supply of the precious metals, and their market value will fall rapidly.

Christendom and Asia may be compared to two tubs standing side by side, and connected by a large open tube half way from the ground, and the supply of the precious metals to a stream of water falling into the tub representing Christendom. Before the water reached the tube, or before the tube was well opened, the level rose very rapidly in the first tub; but now the stream pours so swiftly into the second that the level can scarcely rise at all in the first. When the liquid gets up to the same level in both tubs, then it will rise with equal pace in both.

The quantity of silver annually exported from England and the Mediterranean to Asia has been as follows:

	England.	Mediterranean.	Total.
1851	$8,362,500		$8,362,500
1852	12,116,210		12,116,210
1853	23,550,000	$4,240,000	27,790,000
1854	15,555,000	7,255,000	22,821,000
1855	32,075,000	7,620,000	39,695,000
1856	60,590,000	9,950,000	70,540,000
1857	86,477,170	10,180,291	96,657,461
1858	25,444,250	16,150,000	31,594,250
1859	33,298,120	7,340,280	40,638,400
1860	40,620,182	8,120,204	48,740,386
1861	36,399,175	7,980,000	44,379,175
1862	53,551,045	9,150,000	61,701,145
1863	38,236,191	29,281,000	67,517,191
1864	37,079,196	41,255,942	78,335,139
Total in fourteen years	503,365,035	147,522,718	650,885,753

The figures from 1851 to 1862, inclusive, in the above table are copied from Hunt's Merchants' Magazine for August, 1863, and those for 1863 and 1864 from newspaper reports.

Michel Chevalier says that in 1857 £20,145,921 were sent to Asia, or about $100,000,000.*

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* Michel Chevalier on Gold, p. 65.

The Westminster Review for January, 1864, says:

> In spite of our trouble in India, and a state of chronic warfare in China, the increase of our trade with the east during the last 10 years has been enormous. This, too, may be looked upon as only the beginning of a commerce that must grow to proportions which cannot be estimated. The most important feature, too, of eastern trade is the manner in which it absorbs the precious metals. This is a peculiarity so intimately bound up with the social condition of the east that it is likely to last as long as their ignorance and mutual mistrust. Until a system of credit can grow up among them like that which in Europe dispenses with the use of gold and silver for almost all things but retail transactions and the payment of labor, the east must ever remain a perfect sink for the precious metals. What amount of money would be sufficient to saturate the hoarding propensities of these hundreds of millions of men who believe in nothing but the little store they know of under some hearthstone or other favorite hiding place? There is no practical limit to the demand of the east for the precious metals except the industry they can develop in its acquisition, and that industry is susceptible of indefinite development.

This passage is written in the supposition that a nation possessing an immense quantity of the precious metals in proportion to population could be a nation of hoarders. This idea, however, is entirely erroneous. There never was, nor is it probable that there ever will be a wealthy nation of hoarders. With the exception of a few miserly individuals, hoarding is caused only by the lack of opportunities to invest profitably; the insecurity of titles to real estate, and the dangers of famine and war. Hoarding is far more frequent relatively in semi-barbarous than in civilized communities; more frequent in the country than in cities. As wealth increases, as education extends, as wars become rare, and as the titles to property become secure, the motives for hoarding cease. Hoarding is no doubt common now in Hindostan and China; but the main demand there for the precious metals is not for hoarding, it is for currency. We ship treasure to Asia because, on account of the greater scarcity of the precious metals, labor is cheaper, and because for that reason tea, cotton, rice, silk, and many other articles can be produced cheaper there than here, and we find it more profitable to import than to produce at home. But the Hindoos and Chinese having far less trade and manufactures relatively than Europeans, do not need so much coin relatively, and the increase of the precious metals is ten-fold faster among them than the increase of business; so wages must rise, and their products must become dearer, and our gold and silver will have less relative value to them, and other of our productions will have more relative value. Then our international trade will be more of exchange than now, and less of sale. Asia will always be a sink of the precious metals in so far as immense quantities must be lost, worn away and used in the arts amidst such vast multitudes of people, and as the consumption is great and the yield nothing, there must be a steady stream pouring in; but this stream after the level of industry has once been reached will be much smaller relatively than now.

The countries where labor is dearest must export treasure to those where it is cheaper, and the quantity of treasure that a nation will swallow up is proportioned to its industry and poverty.

Another late writer says:

> Regarding the amount of gold and silver afloat as currency in the various countries of the civilized world there are very conflicting opinions, but estimating the amount of gold and silver circulating as coin in Great Britain, the country in which perhaps the greatest economy of the precious metals consistent with the maintenance of the proper safeguards is observed, at £80,000,000, and the population at 30,000,000, and estimating the currency of India in 1857 at an equal amount, an estimate I venture to think high, and the population at 180,000,000, it requires but very little calculation to show that India is capable of yet absorbing silver to the amount of $400,000,000 in addition to this amount for the purposes of currency alone. Nor must it be forgotten that India is able to support a population many millions more numerous than she at present possesses; nor on the other hand that England has many means of economizing the use of coin, which in consequence of her immense extent of area will be denied to India, if not forever, for many years to come. If, then, it be admitted that there is even a shadow of truth in these estimates, it may not be unreasonable to conclude that there is a possibility, distant it may be, yet still a possibility, of the requirements of India for currency purposes approaching the enormous sum of $500,000,000 in silver coin.*

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* The Drain of Silver to the East and the Currency of India, by W. Nassau Lees: London, 1864.

It is useless to attempt to say how much currency a nation may use. The amount depends greatly upon its relative value. In an age when a day's work is worth 10 cents, only one-tenth as many dollars will be needed for currency, other things being equal, as in an age when a day's work is worth a dollar. Wages in India will not remain at their present low rate, and their rise will, in itself, make a demand for money. We may presume that an addition of $2,000,000,000 to the currency of Hindostan would raise wages there to the level in Europe, and after that importation of silver would be only sufficient to compensate for the wear and tear. However, long before that amount could be added to the currency of India, the Hindoos would demand more European goods than now, and these would pay to a certain extent for the goods exported from India, and the transfer of the precious metals would gradually decline. The larger the stock of money relatively, the higher the wages, and we may expect that when the sum of $4,000,000,000 is added to the currency of Asia, the wages then will be as high there as they now are in Europe; but before that time the wages may have doubled in Europe.

A GREAT INCREASE OF PRODUCTION PROBABLE.—A great increase in the production of both gold and silver is probable. In California, Australia, and Siberia, gold mining is now conducted under many disadvantages. In the two former wages and interest are exceptionally high, and in all there is a lack of that thorough knowledge, and of those economical modes of working, which can only be adopted by a generation educated to the business, and devoted to it as a life-long occupation.[*] In Spain and Brazil, which were once very rich in gold, and would probably pay for hydraulic washing, there must be numerous quartz veins that are now untouched.

These will be made productive. The Andes and the Altai will be explored with care, and hundreds of veins, as rich and large as those of Potosi and Guanajuato, will be found. Machinery will be improved, so that tunnels or adits large enough for wagons can be bored 20, 30, or 40 miles long through high mountains, so as to pay for purposes of travel, and at the same time any lodes that may exist in the chain will be opened to a depth far below anything now known in mining. The great lodes of the future will not be discovered by such accidents as those which revealed Potosi, Cerro Pasco, Sombrerete, Chañarcillo and the best mines of Catorce. If veins like those could be found by chance, what will not the well-directed explorations of the future find? It is scarcely to be doubted that a large tunnel commenced 1,500 feet above the sea level on the western slope of the Sierra Nevadas at any point between latitude 30° and 40° would, in the course of 10 miles, run through a multitude of rich lodes. We have reason to believe that when the great mountains were formed, numerous large fissures running in some places for hundreds of miles were filled with auriferous and argentiferous quartz, and we fail to find them, not because they are not there, but because they are covered with earth, and because the clambering hunter, the benighted wanderer, or the charcoal burner does not pull up the bush or does not light the fire at the right spot. A tunnel running through the Andes commencing near Lima or Santiago would reveal wonders, and the progress of mechanical industry is so marvellous that we are justified in hoping, if not in expecting, to see immense tunnels 20 or 30 miles long cut through high mountain ranges.

RELATIVE VALUE OF GOLD AND SILVER.—It is impossible to ascertain now when or how the difference arose between the market values of the two metals.[†]

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[*] The bill introduced by Mr. Stewart, of Nevada, providing for the establishment of a national school of mines, is designed to remedy the present wasteful system of mining.

[†] Mr. Albert Gallatin, in a letter to the Secretary of the Treasury (Ex. Doc., 1st sess. 28th Cong., p. 1071) on the relative value of gold and silver, says, under date of December 31, 1829:

"The relative value of gold and silver bullion differs from that of gold and silver coins, It may be said that they are almost equally suitable for the purposes of money. Gold has a higher specific gravity and is susceptible of a higher polish, but the difference in these respects is not great enough to cause a difference of 50 per cent. in value between them. There is reason to doubt whether the relative values were ever proportional to the relative supplies. We have no precise information about supplies before the beginning of the 16th century. At that time an ounce of gold was worth 11.4 ounces of silver. In the course of three centuries previous to 1800 the stock of the precious metals in Christendom had increased $5,800,000,000, of which two-thirds in value and 96 per cent. in weight was silver; so that if the value of the two metals had been proportionate to the supply, one ounce of gold ought to have been worth 30 of silver in 1800. Notwithstanding the immense production of silver in the 18th century, the relative value of the two metals was precisely the same in 1816 as in 1717; and notwithstanding the vastly greater relative production of gold since 1849, the relative values have scarcely changed. We observe, too, that although gold is very scarce in India and Asia, it does not bear so high a price as in Europe. The mere fact that gold is worth 15 times as much per pound as silver makes a demand for it, because it is so much more convenient for use.

Although the values have not been regulated strictly by the supplies, it is certain that they have been affected by them. In consequence of a great increase in the supply of gold during the life of Julius Cæsar, an ounce from being worth 17 ounces of silver fell to be worth only nine;* and in the last 300 years gold has risen, relatively, more than 30 per cent. in value.†

Mr. E. B. Elliott, of Washington city, has kindly furnished the following data on this interesting subject. The annexed tabular statement has been prepared by him with great care, and differs in some respects from that of the Merchants' Magazine:

Ratios of the market values of gold to silver, in London, for the 70 years from 1760 to 1829, inclusive, and the 26 years from 1841 to 1866, inclusive—in all, 96 years.

1760 to 1789 (30 years)	14.50 to 1	Prior to the opening of the gold mines of California and Australia.
1790 to 1809 (20 years)	14.90 to 1	
1810 to 1819 (10 years)	15.50 to 1	
1820 to 1829 (10 years)	15.80 to 1	
1830 to 1840 (11 years)	....	
1841 to 1848 (8 years)	15.83 to 1	

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and is liable to greater fluctuations. Independent of these, there are two reasons which make gold bullion more valuable in relation to silver bullion than gold in relation to silver coins. It is more expensive to coin ten silver dollars than one gold eagle, which, if the charge for coining is the same for both, makes, in proportion, the silver coin more valuable, and the unavoidable difference between the legal and the actual standard of the most faithful coins, as well as the similar original difference of weight and the diminution arising from wear, are more sensible and greater in value in gold than in silver coins, so that the loss in melting the current gold coins of any country may be fairly estimated at one-half per cent."

* Chevalier, page 118.

† Hunt's Merchants' Magazine for August, 1863, contains the following table, showing the relative value of silver to gold at various periods from 1344 to 1863, as shown by the prices paid by the mint in London:

1344	1 to 12.475	1547	1 to 11.400
1349	1 to 11.141	1549	1 to 11.250
1356	1 to 11.286	1552	1 to 11.186
1401	1 to 11.350	1553	1 to 11.198
1421	1 to 10.527	1560	1 to 11.315
1464	1 to 10.331	1600	1 to 11.100
1465	1 to 11.983	1604	1 to 12.109
1470	1 to 11.446	1626	1 to 13.431
1482	1 to 11.429	1666	1 to 14.485
1509	1 to 11.400	1717	1 to 15.209
1527	1 to 11.455	1816	1 to 15.209
1543	1 to 12.000	1849	1 to 15.632
1545	1 to 10.714	1852	1 to 15.371
1546	1 to 10.000	1863	1 to 15.069

Discovery of gold fields in California, 1848.

1849 to 1852 (4 years) ......15.60 to 1—Transition period.
1853 to 1858 (6 years). .....15.34 to 1 }
1859 to 1862 (4 years) ......15.34 to 1 } Since the opening of California and Australian gold
1863 to 1864 (2 years). .....15.37 to 1 } fields, average 15.38 to 1.
1865 to 1866 (2 years). .....15.46 to 1 }

Simplest, and probably most convenient, mint ratio of gold to silver, 15 to 1; present United States mint ratio of gold to fractional silver, 14.88 to 1; United States mint ratio of gold to silver dollar, (circulation limited because overvalued,) 16 to 1: British mint ratio of gold to silver, 14.28 to 1: French mint ratio, gold to silver 5-franc piece, (circulation limited because undervalued,) 15.5 to 1: French mint ratio, gold to debased smaller silver coinage, 14.38 to 1.

The ratios since 1859 were deduced from the semi-monthly quotations of the price per ounce of silver bars in London, published from time to time in the journal of the Statistical Society of London. From 1841 to 1848 the values adopted were computed from data furnished by Mr. Wm. Newmarch in a valuable paper read by him before the London Statistical Society and published in the journal of that society. From 1760 to 1829, inclusive, the values were taken from the Funding System of Mr. Jonathan Elliott, which forms part of the Executive Documents of the second session of the 28th Congress. For the 11 years, 1830 to 1840, inclusive, there is a lapse in the information furnished; but it is deemed safe to assume the ratio for this period as 15.8, the ratio of the periods just prior and subsequent to the interval.

It will be observed that with the discovery and working of the California and Australian gold fields the relative value of gold to silver fell from an average of 15⅞ for the eight years 1841–'8, just prior to this event, to an average of 15⅜. for the 14 years 1853–'66, which followed the transition period of four years 1849–'52.

The ratios adopted for the purposes of coinage by the mints of the United States, Great Britain, and France, respectively, are herewith given. Comparison of the data indicates that the simplest ratio which could safely be adopted for the purposes of coinage at the mint is 15 to 1, a rate sensibly lower than the market ratio for at least 60 years, and destined, it would seem from the present upward tendency of the value of gold as compared with the market value of silver, to remain so for years to come. The silver coins are thus, by the adoption of this simple ratio, overvalued, which is now the settled policy of the civilized world, and if made legal tender only in payment of small sums, as is at present the case in the United States, in England, in France, or in many other countries, would circulate freely with our present standard gold coin—the latter, of course, being made legal tender in all amounts.

The importation of silver from the silver-producing countries into Great Britain, and the price per ounce for bar silver in London at various times since 1848, are shown in the following table:

Year.	Ounces.	Shillings per lb. troy.*	Year.	Ounces.	Shillings per lb. troy.*
1848	17,337,226	59½	1857	16,798,163	61¾
1849	20,486,600	59¾	1858	9,017,458	61⅝
1850	14,715,247	60	1859	11,909,246	62$\frac{1}{16}$
1851	16,304,403	61	1860	16,624,696	61$\frac{11}{16}$
1852	18,848,521	60⅝	1861	19,954,001	60$\frac{13}{16}$
1853	17,421,714	61½	1862	20,828,538	61$\frac{1}{16}$
1854	16,797,442	61½	1863	....	61½
1855	14,868,935	61¼	1866	....	62
1856	17,041,761	61⅝			

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* Or, which is the same thing pence per ounce troy.

It was expected about 1853, when the permanence of the Californian and Australian gold mines was no longer a matter of doubt, that the relative value of gold would soon fall as much as it had risen in the sixteenth century, but this expectation has not been realized. It is impossible now to foresee or to form any confident opinion whether gold will fall in value, as compared with silver, if the present relative production is maintained. Chevalier contended, in 1857, that if it were not for the fact that France, since 1850, had been changing her currency from silver to gold, the latter metal would have fallen greatly in value; and he called France the parachute of gold.* From 1850 to 1857 the French mint coined $540,000,000 in gold, or an annual average of nearly $80,000,000, while for 45 years previous to 1848 the annual coinage of gold had been only $4,450,000. His argument would seem to be that so soon as a gold currency had been substituted in France, gold would fall, but since 1857 enough of that metal has been poured into Europe to supply nearly all the nations with gold, and still there is no noteworthy change in relative value.

There is such an immense demand for ornaments and table-ware made of the precious metals, that a long time must elapse before it can be supplied. We must expect, too, that at no distant time Asia will use gold extensively for currency, and in fact it has already commenced to do so. We consider it entirely useless to endeavor to predict the relative value of gold and silver in the future. The financial and commercial history of the world during the last ten years does not establish Chevalier's idea that gold as related to silver will soon commence to fall in proportion to the excess of its production. According to his theory the fall should have commenced already. In 10 years that have elapsed since he wrote $1,200,000,000 have been added to the possessions of Christendom, more than enough, if his estimates were correct, to overstock the market. But the market is not overstocked, as we know from the fact that the price is not materially changed. It is undeniable, however, that the market would soon be overstocked in Christendom if there were no outlet. Gold, except for purposes of small change, in sums less than two dollars and a half, is far more convenient than silver, and is preferred for most of the purposes of coin; and that preference will extend to Hindostan and China so soon as we have no more silver to spare. We have now an excess of silver or we would not ship so much away; and so soon as we have no longer an excess, the European and American merchants in Asia will tell their customers that they must take gold in payment. The more intelligent Chinese see the great advantages of a currency of gold coin over a bartering for silver bars, so the more precious metal has already come into considerable use, and those Asiatics who have done business in California and Australia will help to make the change. If it could be proved that all the gold must be confined to Europe and America while Asia should continue her demand for silver, then a great fall in the relative price of gold within a brief period would have to be admitted; but that proof cannot be furnished. Some fluctuations have taken place in the relative value of the two precious metals within the last ten years, but they are too slight to furnish a basis for conclusions of any importance.

The coinage of all the nations fixes the comparative prices in such a manner that no change can occur without overcoming obstacles which did not exist 200 years ago. Throughout Christendom the governments and the merchants say that one ounce of gold shall be worth 15 of silver; and to prevent any question about the precise relation, coins of both metals are in universal use with a conventional value. The value is conventional to a great degree; we know that it does not bear any precise proportion to the supply. If the value is now conventional why should not the conventionality stand? A change in such a matter necessarily implies loss and inconvenience. The present relative prices of the two metals are very well suited to the wants of commerce. We can pay large sums in gold without overloading a man; we can pay small sums in silver with coin not too small to be handled or carried in the pocket. It would be very inconvenient to have all our coin of equal value per pound, for then large sums would be burdens, or small coin would be too small for our fingers. In fact two metals are hardly enough and so copper and brass have been used for coinage by most civilized nations, in addition to the precious metals. Chevalier[*] says, "Nobody can say that some day silver may not also undergo a great fall, brought about by a production which should be distinguished by the two following characteristics: Of being much greater in comparison with the employments to which it had hitherto been applied, and of being produced under more favorable circumstances, that is at less cost per kilogramme for the metal obtained. There are strong reasons for thinking that if the United States annexed Mexico and penetrated further into the regions of Central America, this event would not be of tardy accomplishment under the auspices of a race so industrious and so enterprising as the Anglo-Saxons."

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* Chevalier, pp. 59, 73.

How Individuals are Enriched by Mining.—The first effect of the production of the precious metals in rich mines is that it enriches the individual engaged in mining, or at least gives him an opportunity to enrich himself. A large proportion of mankind are so stupid, so imprudent, so wasteful, or so indifferent to the value of money, that they cannot make money when they have the best of chances, or keep it after they get it. The wages of miners are higher than those of other laborers, and when the mines are very rich the proprietors become possessed of immense sums. In the mining districts nearly every man when he goes out walking over the hills keeps a lookout for "indications," in hope of finding some vein that may make him a millionaire.

The poorest white laborer in California working by the month gets a dollar a day besides board, and as the French or German laborer in Europe receives less than 50 cents a day, the Californian can, with his earnings, hire two Europeans to work for him, or he can purchase as much as two can produce, or he can afford to consume as much as two European laborers do. He wants their merchandise and they want his gold; so he exchanges one of his days' work for two of theirs. In this way he may live rich, even if on account of his extravagant habits he does not die rich. But the disproportion between wages in California and Europe is still greater in other occupations. The average pay of laborers and the average profits of business men in California are from three to five as great as in continental Europe for labor or business of the same kind, and the difference represents a ten-fold profit. If it costs 75 cents per day to live, the man who gets one dollar per day can lay by capital twice as fast as the man who makes only 87½ cents. If the laborer of California had lived during the last 17 years with as little unnecessary expenditure as the laborer of Germany, there would scarcely be a man among the old residents without his thousands.

How Nations are Enriched by Mining.—The second effect of the production of the precious metals is to enrich the nation which possesses the mines, or to give it an opportunity to enrich itself. Nearly all mining districts are poor, although they consume luxuries which can elsewhere be afforded only by the wealthiest. The finest silks and the most costly wines went to Virginia City during the great bonanza in 1862, and similar extravagance had been witnessed before at Potosi, Cerro Pasco, Guanajuato, and Zacatecas. The owner of a rich mine cannot dig out the pure, precious metal with a shovel unassisted; he must employ a great number of laborers, and his money runs all through the community and stimulates every branch of industry. The whole nation feels rich, and it purchases for one day's work the productions on which other nations have spent two day's. The gold and silver are sent abroad to purchase those things which can be made cheaper abroad where labor has not felt the stimulus.

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[*] Page 142. See also Chevalier's Political Economy, section III, chapter I and II.

How the Precious Metals Fall in Value.—The third effect of the production of the precious metals in large quantities is that the prices of other articles generally are effected. We want gold and silver for coin and for use in the arts, and the smaller the supply relatively to the demand the higher the value. The experience of ancient as well as of modern times has proved this principle. After Alexander conquered Persia, and enriched Greece with the spoils of Asia, three times as much silver was required to pay for a day's work as before; and now it requires in average years six ounces of silver to purchase as much wheat in Europe as could be bought in 1490 for one ounce.* The cause of the change is the great relative increase in the supply of silver while there is no relative increase in the supply of wheat. The result of the great yield of the silver mines of Peru and Mexico in the 16th century was that between 1550 and 1600 wheat trebled in price. The production of the 16th century was about $690,000,000, whereas, the production of $4,000,000,000 in the 18th century added only 50 per cent. to the price which wheat bore in 1600, but more than 200 *per cent. of the price which it bore in* 1500.

When we compare ancient with modern times we see that the rise in prices was very much greater relatively in Rome after she became mistress of the world than it has been in modern Europe since the mines of America, Australia and Russia have yielded their treasures. The difference is owing partly to the fact that a large portion of the laborers in the Roman Empire were slaves, and the number of those who used money and could possess plate was comparatively small, and civilization was confined within narrow limits.

The decrease of prices was less in proportion to the production of the precious metals in the 17th than in the 16th, and less in the 18th than in the 17th century, because business has increased with much greater rapidity in late times than before. Commerce, manufactures, and intelligent agriculture have grown wonderfully. Many branches of trade conducted mainly by barter several centuries ago are now managed exclusively with money. The laborers are all free, and each needs a stock of coin with which to make purchases in case of necessity. The use of silver table ware and of gold ornaments is very extensive, and large quantities of both gold and silver are used in various kinds of manufacture. The introduction of steam in mills, boats and cars has doubled the productive capacity of mankind, and far more than doubled the demand for money. The speed and cheap communication between all countries has added vastly to the general wealth, and has increased the demand for the representatives of wealth. The remotest parts of the world are now brought to our doors, and China and Hindostan open their laps to receive our gold and silver and prevent it from falling in value by becoming too abundant in our hands. One of the best indications of the increase of trade and the spread of civilization is the relative value of the precious metals, and we see that a net increase of $500,000,000, or an addition of 250 per cent. to the stock in the 16th century, trebled prices in half a century, while a net increase of $5,300,000,000, or 900 per cent., since the year 1600, has not trebled prices in the last 250 years.

Influence of Increased Productions on National Debts.—But whatever may be the relative position of the two metals, it is very certain that the time is not far distant when the price of the two as compared with other products of human labor must fall. They are now increasing far more rapidly than is the demand for them, and at the present rate of increase they would soon have to begin to fall perceptibly. But the production will become much greater than it is. The vast improvements that have been made both in gold and silver mining within the last 20 years are applied to only a few mines; and the reward for those who introduce them into other parts of the world are so large and so certain that the introduction cannot be delayed to any remote period. If all the argentiferous lodes of Mexico, Peru and Bolivia, known to be rich, were worked with the machinery used at Washoe, their yield would really flood the world. The placers of Brazil, exhausted for the slow processes known a century ago, will yield treasure greater than they ever produced before. The hydraulic process is needed in Siberia, and in Africa, and in many placers as worked out.

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*Chevalier, p. 18. Jacobs, Vol. II., pp. 71, 113, 216.

It may do very well in European monarchies, where it is considered a wise policy, to preserve wealth in those families which have it now; but in the United States our customs and our laws favor the individual rather than the family. We have no nobility, no princely salaries for officials, no hereditary titles, no social reverence for blood, no primogeniture, no law of entail, no hampering of the sale of real estate, no restrictions of education to the wealthy, no exclusive governmental favor for the rich. We are accustomed to see the rich become poor, and the poor become rich; and we are proud of our country because here the career is open to talent, while in Europe it is, comparatively speaking, open only to hereditary wealth. Most of the rich men of Europe are the sons and grandsons of rich men; in the United States the rich men are mostly the sons and almost invariably the grand-sons of poor men. We are then not frightened to think that those families which hold large sums in government and other bonds should be poorer in half a century than they now are or were thousands of years ago. New deposits of silver will be found, and the innumerable rich lodes in the Pacific slope of the United States, not yet opened, will be worked with profit. The mining processes are now being studied by numerous learned and able men, and improvement after improvement will be made in the modes of reduction.

The inevitable fall in the value of the precious metals will be a benefit to mankind generally. It will reduce the wealth of the rich, and the debts of nations. The dollar of debt which represents the day's work of a common laborer, will, before the end of the century, represent only four-fifths, perhaps only two-thirds of a day's work. Thus, national debts now existing will be reduced 20 or 33 per cent.—the interest as well as the principal. The decrease, however, will be so slow that it will scarcely be felt by any one person; so the general public will be benefitted while individuals will lose little.

Chevalier thinks that government should do all in its power to keep the relative value of a dollar at the present standard; but it would be hard to find any good reason for such a policy.

The amount of bonds outstanding to be paid by the United States for national, State, county, city, and railroad debts is not less than $5,000,000,000, and a reduction of 50 per cent. in that debt by a fall of 50 per cent. in the value of gold and silver, will be a vast benefit to the nation. Chevalier assumes that gold will fall, and he urges France to make silver the only legal tender, so that loss to the bondholders and the gain to the government may be as little as possible. He says, "if both metals remain legal tender, as they then were in France, debtors will pay in whichever proves to be the least in value." While a change from the present policy in this country and in England, France and many other countries would seem to be of very doubtful expediency, it might be worthy of consideration, under certain contingencies, whether our government, looking at the matter from a different stand point, should not make both metals legal tender, so that the government should have the benefit of any change in relative value.

FOREIGN STATES AND TERRITORIES

LOWER CALIFORNIA.*

Geographical and Physical Features.—The peninsula of Lower California extends from the 23d to near the 32d degree of north latitude, about 775 miles in a direct line, and varies in width from about 35 miles in its narrowest part to more than twice that where it is widest. Bounded on one side by the Gulf of California and the Colorado river, and on the other by the Pacific ocean, it has a coast line greater in proportion than almost any tract of similar area in the worl[illegible]or is this all; owing to its extremely irregular outline, this coast is almost a su[illegible]of bays, harbors, and roadsteads, furnishing convenient depots for the numerous w[illegible]o resort here.

The general impr[illegible]n seems to have been that the whole peninsula was a mass of rugged mountains, dry, barren, and desolate. This is by no means the case: there are mountains, and a large part of the country is dry and desolate enough; but it has many redeeming features, and wherever water exists its fertility is astonishing. That portion lying south of La Paz is by far the roughest, has the highest and most rugged mountains, the deepest valleys, and is in all respects the most picturesque. The San Lazaro chain starts as low hills near Cape San Lucas, and running north and northeast, culminating in the peak of San Lazaro, perhaps 5,000 feet high, falls near Triunfo to not much more than 1,000 feet, and continuing northeast again, rises in the high and frowning masses of the Cacachilas, making a most imposing background to the beautiful town of La Paz, as seen from the bay. Small spurs run out from the San Lazaro chain down to the west coast, while eastward spurs and nearly parallel chains fill in the whole area to the eastern coast. Beautiful valleys nestle among these mountains. The valley of San José del Cabo runs northward, east of the high mountains, about 20 miles in length, much of it in a high state of cultivation, and with much more that could be easily rendered arable at trifling expense. Other valleys, smaller in size but similar in most respects, occur, scattered here and there, and even on the summit of the high spur known as the Sierra de la Victoria is said to be a long chain of little valleys with the richest soil, finest of grass, a superabundance of clear, sweet mountain water, and bordered by groves and forests of oaks and pines. North of this granite mass, and extending with some trifling breaks to Sta. Gertrudi's or San Borja, lies a belt of table mountains of sandstones. These almost everywhere commence on the west coast as broad plains, rising towards the northeast so gradually that, were it not for their being cut by innumerable cañons which show their steadily increasing height, one might still believe himself to be but a few feet above the ocean.

The regular elevation of the tables continues to within a few miles of the gulf, where a sudden descent cuts them off with a face so precipitous that, except in a very few places, it is impossible to find a pass by which to reach the coast. Seen from the west side, the mountains look like a sea of flat tables, barren and covered with loose stones; while from the eastern face they are steep, rugged, and so serrated as to lose entirely their tabular form. On this side, and adjoining the coast, are some good little valleys; south of Loreto, for perhaps 20 miles, is a tract of level land bordering the coast, and often a couple of miles wide, most of it covered with a fertile soil. Further north, at San Bruno, at San Juan, and again south of Moleje, are broad valleys forming bays in the hills, from three to ten square leagues in area, and all excellent land, only requiring water to be brought to the surface to render them valuable. On the west side, adjoining the Pacific, is a plain from near Todos Santos to the mouth of the arroyo of Purissima, about 150 to 200 miles in length, and with an average width of perhaps 10 miles, more than half of which is covered with good fertile soil, but without water. In the various cañons which cut the mesa lands, embouching on this plain, are little valleys of from a few acres to several square miles in extent, usually well watered, and some of them in a high state of cultivation. Further north, between the bays of Ballenas and San Sebastian, the plains exist again, merging into mesas on the east, but separated from the sea by a range of granite mountains parallel with the coast, known as the Sta. Clara range. Still further north, these plains continue with occasional interruptions to Rosarita, where they are cut off by the rolling mountain masses reaching the west coast. These northern plains are, however, for the most part deserts, though a portion could perhaps be reclaimed.

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* Exploration of Lower California.—An important and interesting scientific reconnoissance of the peninsula of Lower California was made last year, under the direction of Mr. J. Ross Browne, who organized a party in San Francisco, consisting of Mr. Wm. M. Gabb, of the State Geological Survey; Dr. F. Von Lohr, of the School of Mines of Freiberg, and a corps of assistants. The results of the expedition have not yet been published. Mr. Browne and his party landed at Cape St. Lucas, from which point they proceeded by the coast trail to San José del Cabo; thence through the valley of the same name to the mining district of Triunfo, near the town of San Antonio. Here they spent several days examining the mines; after which they visited La Paz and Pichilingue, on the Gulf of California. At La Paz they had an interview with Governor Pedrin on the subject of the proposed colonization of the Territory by Americans. The general feeling of the people on that subject seemed to be favorable; but no encouragement was given to the project by the officers of the Mexican government then in power. Judge Galvan, who has since become governor of Lower California, is not considered inimical to American occupation; and the probability is, he will use his influence to promote the settlement and development of the Territory, should he be permitted to remain in power, which is questionable. On returning to Triunfo, Mr. Browne and his party procured an outfit of pack-mules and saddle-animals, and crossed the peninsula to the bay of Todos Santos. From that point they made a dreary journey up the coast to the bay of Magdalena. Water is scarce along the trail, and the country presents but few attractions, having an almost uninterrupted desert of sand and rocky masses, sparsely covered with cactus and thorny shrubs. At Salado, an isolated water-hole, seven miles from Magdalena, the party encamped to recruit their animals. Several days were spent in visiting the neighboring shores of Magdalena, but no water was found nearer than Salado, and the whole country seemed to be without resources. Two whale-ships lay at anchor, from which Mr. Browne procured a boat and crew to make an exploration of the bay. Dividing his party, he started the main branch of the expedition across to Loreto, and thence, as experience and the object of the reconnoissance might suggest, northward through the peninsula to San Diego. Having made a careful examination of the bay of Magdalena and its shores, and gathered material for an interesting report, Mr. Browne crossed the peninsula again, via San Hilario, to La Paz, where he remained a short time, revisiting Pichilingue and the Triunfo. Returning thence to Cape St. Lucas, he crossed the gulf to Mazatlan, and from that point obtained passage in the government steamer Suawnee to San Francisco. His forthcoming official report on the mineral resources of the States and Territories West of the Rocky Mountains contains a very interesting and valuable contribution on the geology of the country, from the pen of Mr. Gabb, who, with his party, crossed the peninsula ten times, making the entire trip from Cape St. Lucas to San Diego on mule-back. As this is the first and only scientific reconnoissance ever made of the peninsula of Lower California, the account from Mr. Gabb will be found of great interest and value. (American Journal of Mining.)

Near Moleje the eastern side of the range undergoes a change. The abrupt eastern face falls to some extent and retreats from the coast, the intervening space being filled with rolling hills or barren transverse ridges almost to Sta. Gertrudi's. In this space is the high volcanic mass of Las Virgines, nearly 4,000 feet high, and running westward from it to near San Ignacio is a succession of irregular peaks and ridges of volcanic origin.

By the time the traveller has gone a day's journey north of Sta. Gertrudi's he will observe a change coming in the form of the mountains. The heavy sandstone beds that formed the mesas begin to thin out, only cropping some of the higher hills, the others being peaks, ridges, and spurs of granite with the irregularity of outline which usually characterizes that rock. This transitionary state continues for the next hundred miles, to San Borja, beyond which the range on the east side splits, sending off a branch of low hills to the northwest, the main chain continuing along the east coast. This latter chain continues, high, rough, and forbidding, to Santa Maria, beyond which it extends as a low range of lava-capped granite hills of constantly diminishing altitude, until it is lost in the desert of the northeast. In the mean time, the spur which started from San Borja as a chain of partially isolated hills becomes more marked near the coast, and after passing San Andres it assumes very respectable proportions, growing larger and higher, entirely occupying half the width of the peninsula and connecting with the coast ranges of Upper California. East of this, and north of Santa Maria, the country is represented to be mostly a sandy desert, with a few fertile spots. Scattered through the western foot-hills, and along the flanks of the range bordering the Pacific, are many beautiful and fertile valleys, which will be mentioned more in detail further on.

The water-courses of the country are hardly worthy of a separate mention. Of rivers, properly speaking, there are none. The largest streams are but a few feet in width, except some few in the extreme northern portion, adjoining Upper California. In the valley of San José del Cabo is a little rivulet, fed by the springs in the granite ranges, and furnishing an abundant and steady supply of water for irrigating purposes. A smaller but equally steady stream is found at Todos Santos, and is the means of keeping up the prosperity of the place. Similar permanent streams exist at Comondo, Purissima, San Ignacio, and elsewhere, and by supplying moisture to the soil, enable these places to support a comparatively dense population. These streams invariably sink on reaching the plains, and are lost to the surface, though the water could be regained by shallow wells or carried on the surface by ditches, thereby much increasing their usefulness. This latter plan was successfully followed by the missionaries in several instances, the most valuable of which is at the deserted mission of Guadalupe, where the water of San José creek was secured above the sink and carried several miles in a ditch or canal, the dilapidated ruins of which still exist. At Rosario, San Ramon, Guadalupe, and Fia Juana are streams, one or two of which would be called rivers in Upper California; that at San Ramon and the Rio Fia Juana carrying as much water as Los Angeles river, if not more. Besides the above there are many smaller streams, flowing perennially in the cañons, along a part or the whole of the courses, which I have not deemed worthy of special mention.

Adjoining or lying a little distance from the coast are numerous islands, several of which are from 20 to 50 miles in length. In the gulf the largest is that of the Angel de la Guarda, or the Guardian Angel, said to be rich in minerals, but very rocky and desolate. Further south, below Loreto, is the long, narrow island, noted for its salt, called Carmin island. Still further south, near La Paz, are the three islands known as San Josef, Espiritu Santo, and Cerralbo. On the west coast we have, among many others, the large island of Margarita, forming one side of Magdalena bay; and lying off the coast, opposite the bay of San Sebastian, is the large island of Cerros, or Cedros, claimed to be rich in copper, and famed for its wild goats. Most of these islands are very rough and inhospitable, and entirely unsuited for either farming or grazing purposes.

As before mentioned, the whole coast line might be said to be nearly a succession of harbors. Most of these are, of course, small, shallow, partially exposed, or have some other drawbacks, but several will compare well with any other ports on the west coast. Perhaps the finest is the bay of Magdalena. This bay, in the neighborhood of 100 miles from Cape San Lucas on the Pacific side, is about 50 miles in length and, in places, several miles wide. It communicates with the ocean by two entrances, one at each end of Margarita island, and is well protected to the seaward by the same island. Its importance as a naval station for our vessels cannot be overrated, and if our government does not secure it for this purpose, some European nation will be very apt to make an effort to obtain it so soon as its value shall become known. Should any colony of foreigners ever settle in Lower California, it will probably be placed on the plains bordering the long northern arm of the bay, where the soil is extremely fertile, and an abundance of water can be obtained from shallow wells. Nearly opposite to Magdalena bay is the harbor of La Paz, a fine bay, well protected from all winds, except the fearful hurricanes or "temporales" which blow in the months of September and October, and come from such a quarter as to blow directly up the bay. Eight or nine miles down the bay from the town is a sheltered nook, called Pichilingue, used by the United States war vessel on this station as a coaling station. Here vessels are safely protected on all sides. Half way up the west coast are two large bays—Ballenas, opening towards the southwest, and San Sebastian Viscaino, opening towards the northwest. Into the former empties the San Ignacio lagoon, and into the latter Scammon's lagoon. These lagoons are two land-locked bays, with comparatively narrow entrances, and much frequented by whalers. They are said to have many shoals, though the channels are sufficiently deep for large vessels. It would be useless, in the present connection, to mention in detail the numberless other ports on the two coasts. Suffice it to say that there are many used by the regular coasting trade, such as the Puerto Escondido, the harbors of Loreto, Moeje, Sta. Maria, Sta. Domingo, andmany others.

There is still another item perhaps worthy of notice under this head. Several railroad routes across northern Mexico have been canvassed. Most of these have been spoken of as having their western terminus from Mazatlan northward. Should such an enterprise ever be carried to a successful termination, a short cut across the peninsula would be of value to shorten the distance around the cape. Several possible routes exist, all of which, with one exception, would be required to pass through Purissima or San Ignacio. From the port of San Bruno, or the neighboring one of San Juan, it is claimed that there is a low pass to the head of the Purissima arroyo. I did not visit this; but if a road could be led into the head of the Purissima arroyo it could then reach the west coast at, say the port of San Juanico, without further engineering difficulties. From the port of Santa Inez or San Marcos, above Moleje, an easy route exists up the arroyo of Sta. Aguida to the base of the main chain. Here a mountain, about 600 feet above the valley, has to be surmounted or tunnelled to reach the arroyo of San Ignacio. Another way to reach San Ignacio is perhaps easier, however.

From the port of Sta. Maria, north of the volcano of the Virgins, there is no obstruction, following the arroyo of Sta. Maria until we reach the pass of the Inferno. Here a tunnel of about a mile in length would carry the road to the mesa above San Ignacio, having a gentle grade to the San Ignacio lagoon. The easiest route, however, is from the port of San Luis by way of the arroyo of Calaumjuit, past the old mission of that name, to the mesa of Sta. Ana, along this mesa to the valley of San Andres, and down this valley and the arroyo of San Andres to the coast. Along the whole line there will be no tunnelling required; nature has already made the deep cuts, and there is not a stream to cross. An almost continuous plain extends from coast to coast, without a greater rise anywhere than 30 feet.

GEOLOGY.—The three geographical divisions into which I have separated the peninsula are dependent for their peculiar features on their geological structure. The rough mountains of the south are almost wholly granitic, the table lands of the middle are made up of nearly horizontal sandstones and volcanic rocks, while the more northern portions combine the ragged and irregularly-disposed ridges of the south with occasional flat-topped mountains, capped by rocks of sedimentary or eruptive origin.

All of the higher ridges of the southern extremity of the Territory are made up of granites and sienites, and formed, during the deposition of the heavy bedded mesa sandstones, an island of considerable height and very irregular outline. The structure of these mountains is so simple that a further description is unnecessary. It is not until within half a mile south of the mining town of San Antonio that any change in the geology occurs. Here mica slate is encountered for the first time, and forms a belt several miles wide, and running from Todos Santos, on the southwest, past San Antonio and Triunfo, northeast. It probably extends into the Cacachilas range, and forms there, as at the other mining districts, the country rock of the metalliferous veins. Beyond the mica slate again, on the road between Triunfo and La Paz, granite is encountered, making the face of the range and extending to near the latter town.

In all of the valleys scattered through these mountains, and in some of the lone hills on the east side of the peninsula, are sedimentary formations of a comparatively late geological age. At Santiago I was informed that three miles northeast of that place is a locality where large fossil oysters occur in great abundance, and that they are collected and burnt for lime. I had no opportunity of visiting the locality, a circumstance which I have regretted ever since. A short distance further northeast, near the coast, at a rancho called Los Martyres, is a high hill of sandstones, without fossils, dipping to the westward at an angle of about

15°. From its general appearance it is, in all probability, of the same age as the sandstones which make up the mesas above La Paz. In none of these sandstones have I ever succeeded in finding fossils by which to obtain a clue to their geological age. They probably, however, belong to the same group as the Miocene sandstones of Upper California. They have in many respects the same lithological characters, and bear the same relations to the granites that those rocks hold where we have had an opportunity of proving their age. Besides this very doubtful testimony, there is still another item of evidence which, in the absence of any better, should have some weight. Mr. John Xantus, an able collector, sent from Cape San Lucas to the Academy of Natural Sciences, of Philadelphia, a few fossil oysters, which, if my memory does not deceive me, belong to a species very characteristic of the Upper Californian Miocene—*O. titan, Conrad.* Should I be correct, this is important, though half a dozen years is a long interval, particularly if one had never devoted any especial attention to the specimens remembered.

With so little evidence of their age, therefore, I have hesitated about pronouncing a decided opinion, preferring to leave it an open question, trusting that some future explorer will be more lucky than myself, and discover fossils from which these rocks can be assigned to their proper place in the geological scale. In consequence of the difficulty I have adopted the provisional name of mesa sandstone in speaking of the formation.

In addition to this sandstone, which will probably be found to have a considerable development along the gulf side below La Paz, there is an extensive deposit of horizontal gravels filling or bordering all of the valleys, sometimes making, in part or in whole, the division between them, and lying unconformably on the upturned sandstones, as at the Martyres. This gravel formation is evidently the most modern deposit in the country, perhaps newer than the recognized post pliocene beds, which will be described further on. It is usually made up of debris of the underlying granite, but in some places contains boulders of a porphyry closely resembling some which we encountered several hundred miles further north, overlying post pliocene strata. This porphyry is most abundant in the vicinity of the Martyres, and from there northward. In a few places the gravel is replaced by a fine grained sandstone, and is occasionally, though rarely, disturbed, as at the Cuevas, where it tilted three or four degrees. Almost everywhere this formation takes on the form of level terraces, though often very much cut up by dry gulleys. At Sta. Anita and at Santiago, where they are best developed, these terraces are about 60 feet high and well defined. They also exist at Todos Santos, and northward along the coast for many miles. At Todos Santos the main terrace is about 60 feet in height, but there is also another in the arroyo of about half the height. The latter is limited in extent and seems to be very local. Going northward the elevation diminishes until at last the tabular character is entirely lost. On the northern border of the mountains, approaching La Paz from the south, are encountered for the first time volcanic rocks in place. These form hills of from 500 to 700 feet high, of volcanic ash overlaid by beds of compact porphyries and trachytes. The rocks are pretty regularly stratified and mostly dip to the west and northwest, though northeast of La Paz the disturbance is general, and the dip in every direction. The ash is to some extent quarried for building purposes, and the new church or cathedral now in process of construction is being built of this material.

After leaving the granitic ranges south of La Paz the whole appearance of the country changes, and with it the geological structure. The granite itself has disappeared, only to show itself as one or two insignificant outliers, and in its place come enormous deposits of sandstones forming flat-topped mountains, ragged and precipitous along the east coast, but sloping off so gradually towards the Pacific as to merge insensibly into the broad low plains of the west. Pretty regularly bordering the west coast and occurring occasionally along the gulf are deposits of post pliocene age, in places filled with and almost made up of the casts or shells of mollusca, still living in the adjoining waters. Penetrating both these formations, and often capping one or the other or both indiscriminately, are deposits of volcanic origin. These volcanic rocks usually occur as dikes or broad superficial sheets which have been spread over the top of the mesa subsequent to the deposition of the post pliocene, and are by no means uniform either in thickness or in the manner of their distribution. Very few volcanic cones exist. Almost the only ones are the volcano of the Virgines, north of Moleje, and a series of cones and ridges extending westward to near San Ignacio. Elsewhere the eruptions appear to have taken place in the form of long fissures, forming dikes, which, having spread their surplus over the surrounding plains, have closed, never again to reopen. In this manner immense areas have been covered with caps of eruptive rocks often 100 feet thick, the source of which is now entirely hidden, an occasional hint only existing in the denuded section of some bluff where the dike has been cut through by the agency of running water.

The post pliocene rocks usually lie on the lower margins of the mesa in such a manner as to show that they were deposited during the period of elevation of this portion of the peninsula. The older mesa sandstones are usually so little disturbed that the two formations seem conformable, though sufficient evidence exists to prove that the elevating force had been acting for a long time before the oldest beds of the newer formation were deposited. This later series consists of fine grained argillaceous sandstones and shales, some coarser light gray sandstone, and lastly a thin bed, highly fossiliferous, as are also some of the earlier strata, but the latter highly calcareous. Where the series remains unbroken, this last stratum is always the highest, and it is nearly made up of the casts of living species of shells, *Ostrea Cummingii* being almost the only one retaining its structure. At Purissima, on the west slope, the mesa sandstones have been folded in a series of long and graceful undulations, the tops denuded to a nearly straight line, and the post pliocene lies unconformably capping the surface. On the opposite side of the mountains bordering the gulf there are still more marked instances of unconformability, which will be described in their proper place.

The mesa sandstones are easily distinguished from the overlying rocks by their coarser grain, greater compactness, and above all by their being highly metamorphosed along the greater part of their eastern margins. Another marked feature is the presence of large quantities of boulders and pebbles of volcanic rocks imbedded in them, sometimes to such an extent as to form even a preponderance of the bulk of some strata. These boulders are uniformly small and very much rounded near the west coast wherever the rock is encountered, and increase in size towards the vicinity of Loreto, or rather towards that part of the coast a little below Loreto, in such a manner as to point unmistakably to this region for their origin. Not only does the size increase, but in the same ratio is the increase in number and the decrease in the amount of attrition to which they have been subjected. The lithological characters vary markedly from those of any eruptive rocks encountered in place on the peninsula; no similar rocks have been discovered between the mesa sandstones and the underlying granite, and the only reasonable conclusion which can be arrived at is that they must have been derived from a body of land which formerly lay in that region now occupied by the gulf, and somewhere in the vicinity of, or a little south of, Carmin island.

Another striking feature of this region is the peculiar manner of the elevation of the mesa. It has not been lifted by an evenly distributed force; not, like most mountain chains, by a folding along a given axis. The eastern side seems to have felt this force almost alone, the elevation of that portion lying to the west seeming to be due almost as much to the rigidity of the rocks as to the extension westward of the uptilting power. More properly speaking, the great force was exerted very nearly parallel with what is now the coast line of the gulf, and from there towards the Pacific this agency diminished so gradually as to produce no breaks or even foldings worthy of mention. We thus have the whole width of this portion of the peninsula tilted up by its edge from coast to coast, so that travelling eastward one can hardly realize the rise until, within 15 or 20 miles of the east coast, he finds himself on the verge of a precipitous descent of from 2,000 to 3,000 feet in height. This eastern escarpment extends from near La Paz to near Moleje, with but few interruptions, and exhibits nearly everywhere the projecting edges of nearly horizontal beds of sandstone, sometimes unaltered, but usually metamorphosed. During the imperfect examinations which our limited time permitted us to make I was unable to determine whether this sudden cutting off of the otherwise undisturbed beds was due to a gigantic fault, or whether the eastern slope of an anticlinal axis had been carried away by denuding agencies. From what little we saw, strong arguments could be deduced in support of either hypothesis, but I prefer leaving the question an open one, content with having called the attention of future students to its solution. It is certain, however, that a well-marked axis, if not several, exists further north; and even at the Sauce, near Loreto, the presence of a mass of granite at the base of the Sierra Gigantea, evidently exposed by denudation, seems to point to this agency as the means of solving the difficulty.

On the west side the post pliocene strata form a strip extending from below Magdalena bay to near San Telmo, with but very few interruptions. The eastern margin of this belt is pretty clearly defined by the elevation of the mesa, rarely reaching but a few hundred feet above the level of the sea. It extends to the coast except along that portion lying between the bays of Ballenas and San Sebastian, where the granite range of Sta. Clara cuts it off. On the east side, near Loreto, it occurs as hills several hundred feet in height, uptilted at an angle, as high in parts as 55°, and dipping to the northeast. This disturbance appears to be due in a very great measure to the intrusion of a large mass of volcanic rocks, which separate the more modern formation from the mesa sandstones. The belt continues with slight interruptions to near the Sauce, where the post pliocene sandstones, very full of fossils, lie horizontally, abutting against the face of uptilted mesa sandstones, which are here highly metamorphic.

Proceeding westward a mile or two, the older sandstones become horizontal, assuming this position by a gentle curve, their edges abutting against a mass of granite. Still further west, this granite mass is seen to underlie the undisturbed horizontal beds of the same sandstones, which make the great mass of the mountain. Dykes of trachytes and porphyries cut alike the granite and sandstone, and in a beautifully exposed section on the face of the Gigantea, can be seen running entirely to the surface of the mountain, over whose flat top they have spread a rocky mantle, which extends almost to the plains of the Pacific.

Space forbids me to describe in detail all of the minuter features of the geology of the country. Suffice it here to say that except the retreating of the summit from the coast above Moleje, and the presence of the belt of volcanic cones from San Ignacio to the volcano of Las Virgines, there are no matters of special interest, until we reach Sta. Gertrudis, over 70 miles above San Ignacio, and just west of the summit of the range. Here a mass of granite appears in the bottom of an arroyo, very similar in character to that at the Sauce.

The overlying sandstones are not disturbed by it, but lie horizontally over it, or abut against the irregularities of its surface. Northward from Sta. Gertrudis the mesa sandstones almost disappear, except in the higher mountains to the cost. In this region they seem to retain their former thickness, but little abated to near the bay of San Luis, where very much metamorphosed, disturbed and uptilted, they gradually run out in a series of low ridges. Very soon after leaving Sta. Gertrudis, on the road to San Borja, these rocks thin out, capping only a portion of the higher mountains, the great mass of the country being granite. The other stratified rocks, both post pliocene and volcanic, at times occupy similar positions, and sometimes the whole three are found in their regular sequence on the summit of the same hill. The volcanic, however, has been all of this time gaining ground, while the others are losing, and eventually at the Paraiso, and over the adjoining mesa, it is the only rock found capping the granite. At Trinidad and near Rosarito, below San Borja, a few outliers of post pliocene form hills 200 and 300 feet high, resting on granite, and usually capped by volcanic rocks. Again, at San Andres forming low, flat hills, underlying the valley of San Andres, and forming the broad plains of Sta. Ana, we have the post pliocene extremely developed and extending to and abutting against the highly uptilted mesa sandstones at Calaumjuit. Bordering the northern edge of the mesa of Sta. Ana, and north of the bay of San Luis, extending almost from coast to coast is a mass of granite, which rises at Sta. Maria to a height of about 3,000 feet, and is here capped by thin beds of the same sandstones, which form the plain of Sta. Ana. In most cases this sandstone on the summit of the mountains is capped with a thin deposit of volcanic rocks. The same structure appears to continue northward, as well as we could determine at a distance, as far as the range could be seen. Going westward towards San Fernando the valleys were at first all scooped out in granite, the higher hills being formed at Sta. Maria; but by their steadily diminishing height, the post pliocene first, and eventually the volcanic rocks reached the plains, and the granite disappeared. Crossing the plains of Buena Vista, the road enters the mountains of the west side, near San Fernando, and we found the structure somewhat different from anything we had encountered further south. The structure is essentially that of a broad granite core, flanked by stratified volcanic rocks, with many beds of ash, and not unfrequently uptilted at high angles. This is the case on both sides of the chain, and continues to beyond San Diego. Westward, beyond the volcanic rocks, and adjoining the coast, is a broad belt of horizontal post pliocene beds, which, with occasional interruptions, extends to and even beyond San Diego, being cut off several times where the crystalline rocks reach the coast. We had no opportunity of examining the geology of the eastern side of the range, north of San Fernando, but I have no reason to suppose that any changes of importance take place in that region. From Rosario, where the road reaches the west coast, after passing through San Fernando, our route lay along the western flank of the mountain, sometimes on the beach, sometimes across the late tertiary tables, and occasionally through the rocky foot-hills of the range. There was no important variation from the structure described above along the route, except at the salt ponds of San Quentin, where there is an isolated group of low hills, composed of a dark gray, cellular trachyte, much of it filled with rests of olivene, and some parts having an obscure basaltiform tendency. These hills have no obvious connection with the main range, and the rocks of which they are composed are entirely different from any rocks of a similar origin encountered elsewhere.

VARIOUS RESOURCES OF THE TERRITORY—MINING.—"Prospecting" has been carried on over the whole length and breadth of the country, but, on the whole, without very marked success. In the mica slate range of the south, valuable silver mines have been found, and in the frontiers a single mine of copper has been opened, which promises well.

Of gold mines there have been many, but at the present time not one is being worked. In the granite hills near Cape San Lucas gold has been undoubtedly found, but it seems that the quantity was very small, and the locality is now forgotten. Further north, about San Antonio there has been some placer mining on a small scale. Women have washed the gravel of the arroyo in bateas or wooden bowls, obtaining a pittance per day, and the custom has been kept up during the rainy seasons from time immemorial. Some foreigners who desired to build a dam and wash out the arroyo at once, were refused permission by the authorities, on the ground that it would deprive the women of their time-honored privileges. In the granite mountains from Sta. Gertrudis to San Borja, and even in the metamorphic sandstones, almost as far south as San Ignacio, there are innumerable tunnels, shafts, and "coyote holes," where attempts have been made to find paying quartz mines. They are now, without exception, abandoned. In most cases the veins were found to be unreliable, mere pockets or strings, and even in these the quantity of gold was not sufficient to pay for working.

Similar attempts have been made to discover or develop silver mines. These are reported as existing about San Borja, on the island of the Guardian Angel, on the main land opposite this island, on the island of Margarita, and in numberless other places, none of which have ever yielded anything nor probably ever will.

About 45 miles below La Paz is the mining district of Triunfo and San Antonio. Here there are several veins known, only one or two of which have been sufficiently developed to form a positive opinion as to their value. Mining has been carried on on all of the veins since the time of the missionaries, but only for the purpose of obtaining the decomposed surface ores, which could be amalgamated without roasting. The result of this kind of work has been to expose the veins along the greater part of their course by series of shallow pits honey-combing the surface and rendering travelling across the hills rather perilous to a stranger. These ores (called "azoqué," or quicksilver metal,) were worked in arrastras and amalgamated without difficulty, the silver existing in its metallic state, freed by decomposition of the sulphurets. As soon as the excavations reached the unaltered ores of the deeper part of the vein, known as "fire-metal," they were abandoned and new openings made. About 9 or 10 years ago, however, systematic work was undertaken, by a company from Mazatlan, on a couple of mines called the San Pedros and San Nicholas. They have a body of good ore varying from 15 inches to three feet, mostly of excellent quality, and have been, for a number of years past, in the habit of shipping their first-class ore to Germany. The material shipped averages over $100 per ton of silver, and the expenses of mining, freight, and everything, up to the time of delivery in Freiberg, amounts to about $70. This is too much; the ore could be worked on the spot at a greatly diminished expense, and if the company had their own mill they could work inferior ores, too poor for shipment, and which are now thrown away. The manner in which the mines are worked is execrable, the person in charge having hardly an idea of the first principles of mining engineering.

On the same vein, three or four miles south, are the mines of the Triunfo Company. They possess four mines on this vein and three on another adjoining to and parallel with the first. Of these two have been well opened and are yielding the ore now being worked at the mill. The two are the Mendoceña and Molineña. The former is on the summit of a ridge, and was first opened by an inclined shaft or slope on the vein. The slope, rarely higher than 20°, was, at the time of our visit, about 550 feet deep, with five levels running each way from 50 to 300 feet. The vein is from 8 to 15 feet wide, and throughout carries a body of ore averaging about, if not over, four feet. The lower 50 feet of the vein had a body nearer five than four feet. The ore does not lie in chimneys, but in a continuous sheet, extremely uniform both in thickness and quality. It is a compound of various sulphurets, in which antimony and lead predominate. From a series of carefully made assays, Mr Löhr reports that the average ores, such as are being worked at the mill, contain from $90 to $124 per ton, while picked specimens assayed as high as $225. In the Mendoceña mine alone we computed that there was ore enough exposed on the various levels to keep the present 24-stamp mill running for over five years, working 20 tons per day. Over 900 tons of ore were stacked at the mill waiting for reduction, and on entering the mine we could hardly tell whence it had been taken. Most of it had really been obtained while doing what is usually counted "dead work" in the mine—sinking the slope and running the galleries. The Molineña is on the same vein and adjoining the Mendoceña, taking in the side of the hill. A tunnel was being run on the vein here, intended to strike the base of the slope of the Mendoceña and form its seventh level. By this means a large amount of hoisting will be avoided and all necessity for pumping obviated. The other mines of the company are being opened slowly. One on the adjoining vein has already yielded considerable ore, of a character different from the other vein. In it zinc predominates, and the ore is said to be much less refractory than that from the Mendoceña. This company started with a 10-stamp mill, and having ascertained the proper method of working their ores, replaced it by one of 24 stamps, which was receiving the finishing touches as we started on our way northward. Since then the news has been perfectly satisfactory. The last two steamers have brought to San Francisco bullion to the value of upwards of $30,000, as the result of about six weeks' actual working of the ores. The company, in justice to itself, should at least double its mill capacity immediately.

Besides these mines, which I have described somewhat in detail, because they are the only ones on which work was being actively prosecuted, there are many more on the same veins which have been partially developed, and show every evidence of value. Among these might be mentioned more particularly the Sta. Maria, the Soledad, and the Fortuna. In each of these are good bodies of ore, identical in character with the Mendoceña or the Mexican mines. I cannot here give a catalogue of all the mines which are known or supposed to be valuable; suffice it to say that many others have been opened, and the time will doubtless come when they will be all thoroughly proven. Labor, wood, salt, and, in fact, all the accessories for the mining and reduction of silver ores, are cheaper here than in upper California or Nevada, and as soon as Lower California shall have fulfilled her manifest destiny a new era of life and activity must spring up here, and make this one of the most productive silver districts on the coast.

Copper, like gold, is reported from nearly every part of the Territory; numberless mines have been opened and invariably abandoned. The Delphina mine is the only one that seems at all promising. This mine is in the northwestern part, between San Telmo and Sta. Tomas. The principal work is a shaft about 150 feet deep, which we did not examine, fearing the presence of gas at its bottom. There being nobody present who knew the mine, we did not feel inclined to run any risks. On the surface, however, there has also been considerable work, and the vein appears in a cut, over 50 feet deep, to be very well defined, with distinct walls and from five to seven feet wide. The ores, (of course surface ores,) oxides, and carbonates are usually rich and abundant. Between 300 and 400 sacks are stacked at the mine ready for shipment, and I have been informed that several hundred sacks more of the same character are at San Isidro, the shipping point, awaiting a rise in the market price of copper, so that the proprietors can sell without sacrifice. Of course it is impossible to prophesy the future of a copper mine on the character of its surface ores, but it is claimed that, so far as the work has gone, the vein has not changed materially in character.

Baser metals exist, also, in the Territory, but there has never been any active search made for them, and many a year must elapse before they can become valuable. Coal has been reported in a few places where it does not exist. It is said to be found near the Ojo de Liebre; it may be that some "brea" or asphaltum is found there and the two minerals confounded, a mistake that has often occurred in Upper California.

Salt occurs in almost innumerable localities, but there are three spots which are noted both for the quantity and quality of the mineral there obtained. These are San Quentin, Ojo de Liebre, and Carmin island, in the Gulf. We did not visit either of the latter places, but, contented ourselves with examining the ponds of San Quentin. These ponds or little lakes, half a dozen in number, vary in area from one to five acres. They are situated near the coast among a number of sand hills, and separated from the beach only by low ridges of sand. They are quite shallow, and the salt crystallizes on the mud flats on their margins in flakes of half an inch or more in thickness. By a dexterous motion this salt is lifted, unsoiled from its soft bed, thrown into heaps, whence it is carried to the vessel. At present the place is abandoned. The royalty required by the Mexican government, the cost of collecting, hauling, and shipping, and the high United States tariff on imported salt, in the aggregate amount to so nearly the price of the material in San Francisco as to completely eat up all profits, and thus effectually close the only market to which this salt can be taken.

Sulphur is found in moderate quantities near Moleje, and is said to be very abundant in the vicinity of the volcano of the Virgines.

Gypsum, generally in its crystallized form of selenite, occurs in many places in the post-pliocene rocks, or weathered out from them and scattered over the soil. It also occurs near Moleje, but not in the enormous quantities which have been reported by interested parties.

AGRICULTURE.—The climate of Lower California is so mild that all the usually cultivated plants of both tropical and temperate countries grow side by side in the open fields. The lowest temperature we encountered in four of the coldest months of the year was 57° Fahrenheit, and the winter averages from 65° to 70°, so far as our own experience went. Several species of palms are native, and the date grows wild, thoroughly acclimatized. Plantains and bananas, figs, oranges, olives, lemons, limes, pomegranates, peaches, and, in the northern parts, even apples grow and flourish, requiring but little care when first set out and none afterwards. Vineyards exist everywhere, and the native wine is infinitely superior in quality to that of Upper California. Fields of sugar-cane are too common to excite remark, and the manufacture of sugar is one of the most important interests of the southern part of the peninsula. Tobacco and cotton are cultivated in various places, especially in the valleys south of La Paz, and over more than half the Territory wild cotton is as common a weed as is the Jamestown weed (*stramonium*) at home. The castor bean grows wild, a perennial tree with a woody trunk, and melons are so abundant that during their season they make the greater part of the food of the people in some districts.

The principal agricultural regions are as follows: The vicinity of San José del Cabo and along nearly the whole of the valley and its branches. Here wine, sugar, dried fruits, cotton, and tobacco are the principal products. The cane fields extend as far as the eye can reach from San Jose, and there is still plenty of unoccupied land, only requiring the digging of ditches to render it available. This is necessary, as everywhere else in Lower and in many parts of Upper California. On account of the rains being confined to the wet season, the dry season being literally so, vegetation requires artificial assistance. Santa Anita, 12 miles up the valley from San José, is a lovely spot, connected with San José by an almost continuous line of gardens, and beyond it are ranches scattered along on every piece of bottom land, to the head of the valley. Santiago is a little group of houses surrounded by similar farms and gardens, a sugar-mill or two being engaged at the time of our visit in finishing the work begun by the farmer. Miraflores, Las Palmas, Los Martyres, San Bartolo, and numberless other spots prove that wherever an acre or two of level land, or even hillside, can be irrigated, the yield is such as to make a farmer from the Atlantic States open his eyes in amazement. We Californians are so accustomed to large crops and to seeing nature on an exaggerated scale that we could bear it with a commendable degree of equanimity. About San Antonio are many pretty little patches of ground, which will one day be cultivated, as well as many spots on the road to and in the vicinity of La Paz.

Todos Santo has a valley of one or two square miles, most of which is planted in canes, vineyards, and orchards, and every year yields a fine revenue to the owners.

Many little valleys and nooks exist among the granite mountains of the south, still unoccupied, and which will one day be brought into cultivation.

On the west coast, bordering the northern part of the Bay of Magdalena, and the long arm which extends northward, are extensive plains, nearly level, rising insensibly to the east, and, in great part, covered with a rich soil. These plains, almost throughout, destitute of the scattered stones on the surface which render so much land on the peninsula valueless, are covered with a dense vegetation, of which the larger species of the cactus make a great part. There is no water on the surface, and this fact alone has prevented their settlement by a native population. As soon, however, as land shall become valuable this "monte" or "brush" will be cleared off, wells dug, and nearly the whole tract will be cultivated. Water of good quality and unlimited in quantity can be obtained by shallow wells; the sea breezes will supply the lifting power, and a population greater than can now be found from San Diego to the cape can here find comfortable homes and an abundant subsistence. South of Loreto is a similar but much smaller tract, which also, like the former, has an excellent harbor of its own. Among the table mountains are San Luis, Comondu, Purissima, San Ignacio, and a dozen smaller spots, some of which are in a high state of cultivation, while others are capable of it were there life enough in the people to urge them to it. Purissima alone ships a thousand cargoes of dried fruits annually, not to mention large quantities of wine and sugar.

Comondu has several sugar-mills occupied the whole season, and the thousands of date and fig trees of San Ignacio fairly force their treasures into the hands of an indolent and worthless set of proprietors. The unappreciative and ignorant laziness of these miserable people is enough to keep a live man, passing through their country, in a healthy and almost chronic state of indignation. But one result can follow the American acquisition of Lower California—the indolent mongrel race forming its population must give way before the enlightened energy and restlessness of our own people, as it has done in Upper California and Texas; and Anglo-American enterprise will, within a decade, render this Territory more valuable than would Mexican laziness in a century.

North of San Ignacio there is but little of value in an agricultural point of view until, having passed Santa Gertrudis and San Borja, we arrive at the broad and uninhabited valley of San Andres. This valley, with the adjoining plains of Santa Ana, should, perhaps, be rather classed with the grazing than the agricultural lands. The only water existing naturally on the surface is at the mouth of the valley, where there is a lake of brackish water more than half a mile long even in the dryest seasons. Animals drink it freely, and the grass in the valley seemed unlimited. From the position of the rocks it is certain that water could be obtained by wells, and usually, in localities like this, the well water is good even when that of the ponds is undrinkable. With wells and windmills several square miles of excellent land could be here brought under cultivation, while an almost unlimited quantity of stock could find pasture on the adjoining plains, or in the unoccupied portions of the valley. Further north are the plains of Buena Vista, in which there is no known water, but the remarks on San Andres will, with slight modification, be applicable here also. In the mountains adjoining these plains is the deserted mission of San Fernando. The traces of former cultivation still exist, and a few hundred dollars would be sufficient to repair the irrigating apparatus, so as to bring over 100 acres of good land into condition for planting.

From San Fernando to the boundary most of the arable land is in the possession of private individuals, though some tracts still exist as public property, subject to denouncement, which are by no means to be despised.

After passing St. Tomas we saw cereals growing without irrigations and with promise of excellent crops. Wheat, barley, and oats were noticed, the former with full, large heads and short stalks. Potatoes and apples, adjoining a grain field, on the Guadalupe ranch, reminded us of home, but looked incongruous, associated with olives and figs and overshadowed by one or two tall and graceful fan palms.

Grazing.—Lower California, as a whole, can never be very promising as a stock country. Except in the extreme northern portions, the thorny nature of the undergrowth must prevent the successful raising of sheep for wool purposes, though mutton sheep would succeed admirably were there a market for them. Horses, cattle and mules thrive. The common forage plant is the well-known "bunch grass" so common over the whole Pacific slope. It is not until after leaving San Borja that the alfalfa burr and other clovers, alfilerillo and other Upper California plants, acquire any importance. In the south, where severe droughts are not uncommon, and where, at times, the grass disappears entirely, stock does not suffer. Here tall animals fare the best. Several trees of the acacia family, which never suffer from drought, which grow everywhere, and on which animals feed with avidity, these take the place of the ordinary pasture. The principal of these are the mesquite and lipua. We camped repeatedly where there was hardly a blade of grass in sight, and yet our mules had all the feed they wanted.

The high mesa lands about the summit of the Gigantes, and again between Sta. Gertrudi's and San Borja, are said to be never affected by drought. The constant fogs keep the grass green nearly the entire year, and cattle flourish here no matter how dry the season may be elsewhere. Still further north, between Rosario and San Diego, the country is so nearly like Upper California, and is subject to so nearly the same climatic laws, that it properly belongs with the Southern Coast Range section of the State. It is a series of valleys scattered through the mountains, pretty well watered, and sharing the fortunes of California, good and bad seasons.

Fisheries.—Along the coasts, especially on the Pacific sides, the whale fishery is an important interest. Most of the large bays, more particularly Magdalena, and Scammon's and San Ignacio lagoons, are visited by vessels year after year in search of whales, which frequent these waters, probably for breeding. There are, perhaps, as many as from 12 to 20 vessels engaged annually in this branch of enterprise. Seal fishing has also attracted some little attention, though not as much as it merits. Myriads of seals and sea-lions line the shores and fall an easy prey to the hunter. On the gulf side the pearl fisheries have been among the most famous in the world for more than a century. Ever since its commencement, the annual yield has averaged about $25,000 per year, and it is still carried on, but with diminished activity.

Conclusion.—By reading the foregoing imperfect sketch it will be seen that while Lower California is by no means the faultless country it might be; while by far the greater portion can never be made available for either mining, agricultural, grazing or any other purposes; while its mines are few, its agricultural lands limited, and its supply of water small, still its position, its harbors, its climate, and its resources are sufficient to give it a real intrinsic value. From its position with relation to Upper California, it is much more an appendage to this State than to Mexico, out of sight across the "Sea of Cortez." It commands the mouth of the Colorado, and thus affects the trade of the great interior basin east of the Sierra Nevada. Its harbors are neither few nor small, and they have a direct value with reference to our trade and navy in the Central Pacific. Its agricultural products can be increased in quantity; its fisheries are, as yet, in their infancy, and its mines alone would be sufficient reason for its acquisition by the United States. Further, everywhere outside of the moral influence of La Paz, the seat of government, the people are earnestly in favor of annexation, and I am by no means certain that a popular vote on the question would not result in a decided majority in favor of such a measure.

MEXICO.

Mining in Mexico.—Mexico is peculiarly a mining country, and indeed it has no industry worthy of note save mining. The exportation of agricultural products and manufactured articles does not average 75 cents annually to the inhabitant, while in highly civilized states the average is from $10 to $50.

All the past and present importance of Mexico in the commercial world is due to its silver, which attracted the Spaniards to the country and fixed there and determined the location of their towns. With the exception of the capital, to which, of course, the wealthy men resorted to spend their money, Puebla and Guadalajara, manufacturing towns, and Vera Cruz and Mazatlan, seaports, all the largest towns were built in the immediate vicinity of the mines, or in the agricultural districts nearest the mines. Guanajuato was a place of minor note till its great mineral wealth was discovered in the middle of the last century, and then it suddenly rose to be the second city of the country, and the adjacent plains of Bajio at the same time grew rich by agriculture; and in the same way the mining town of Zacatecas and the agricultural district of Aguas Calientes grew up side by side. Durango, Chihuahua, San Luis Potosi, Alamos, and hundreds of others of less note are strictly mining towns.

The total registered yield of the mines of Mexico from 1521 to 1803 is reported by Humboldt at $1,767,952,000, and he thinks that an allowance of one-seventh should be made for the unregistered yield, giving a total of $2,027,952,000. Ward estimates the quantity produced from 1810 to 1825 at $159,255,840. According to Whitney the yield of Mexico, previous to 1845, was $2,700,000,000; and if we allow an average of $20,000,000 for each of the 22 succeeding years, we have a total yield of $3,140,000,000 from 1521 to the end of 1866.

The average annual yield of the mines of Mexico was as follows, at various periods:

About 1700	$5,400,000	About 1810	$19,000,000
1740	9,000,000	1815	7,000,000
1770	12,000,000	†1820	10,000,000
1790	19,500,000	‡1841	18,000,000
1800	*22,000,000		

The amount coined in 1825 was $8,000,000; in 1835, $11,000,000; in 1845, $15,000,000; in 1856, §$19,000,000; and from 1521 to 1856, $2,636,745,951.

The opening of all the ports of the country to commerce, the great reduction in the price of quicksilver caused by the large production of the New Almaden mines in California, and the gradual increase of educated engineers and of mining machinery, have brought up the production of the country to a higher figure than that reached at the beginning of the century—that is, in years of comparative peace and order, such, for instance, as most of those from 1850 to 1860.

If Mexico had a government as good as that of Chili, and had railroad communication from Vera Cruz and Mazatlan to all the principal mining districts, and were protected against the Apaches, the production would at least double within ten years.

The argentiferous region of Mexico is a long triangle, 800 miles long from southeast to northwest, 350 miles wide at the base on the northern boundary, having the city of Oajaca for its southern point.

Nearly all the mining districts of any note are from 4,000 to 9,000 feet above the sea. The great elevation counteracts the torrid influence of the latitude, and many of the mining towns have very cool climates.

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* Duport, p. 193. † Ib., 194. ‡ Ib., p. 190. § Lempriere, p. 214.

In most of the districts porphyry is found with micaceous schists, and the conjunctions of those two rocks with quartz veins is considered an indication of silver.

The mode of mining generally is very rude. No mine is accessible by railroad, and few have wagon roads. Usually the reduction works are at a distance from the mines, and the ore is packed on mules. The ore is brought to the surface on the backs of men, up steep inclines, or even up perpendicular shafts, the carriers climbing up on notched poles. In some mines the ore is carried by men to the shaft and there hoisted by whim. There is no mention in Humboldt or Ward of tramways and cars to bring the ore from remote parts of the drift to the shaft. Water is hoisted in the same manner as the ore.

Steam was not used previous to the revolution, but it has been coming into use gradually, and now much of the hoisting, pumping, and pulverizing is done by it.

The general practice in Mexico as to pulverization has been to mash the ore to a coarse sand under the stamps, and then grind it fine in arrastras. The degree of fineness varies much in the different districts, partly because of differences in the ores and modes of reduction, and partly because of ignorance and prejudice. At Guanajuato the ore is ground to an impalpable powder; at Zacatecas, Catorce, and Fresnillo, in a coarse flour. In 1842, 82 per cent. of the silver yield of Mexico was obtained by the yard amalgamation; 8 per cent. by the *Cazo* or copper-pan amalgamation, and 10 per cent. by smelting.* In 1800 one-seventh was smelted.†

The proportion of smelted silver has been decreasing gradually, and will no doubt continue to decrease. A hundred years ago it was two-fifths of the total yield.

Since the opening of the Washoe mines and the successful introduction of the iron-pan amalgamation there, a number of mines have been purchased in Sonora, Sinaloa, Chihuahua, Durango, and Lower California, by Americans, who have introduced machinery and American modes of working, and they would probably have obtained some splendid results, at least in a few instances, before this time, if the civil war had not thrown everything into confusion.

The average loss of mercury in the yard amalgamation is a pound and a half to one pound of silver extracted.

The best writers on mining in Mexico agree that the country has great wealth as yet undeveloped, and that a time must come when the production of the precious metals will far surpass anything of the past. Humboldt said he was "tempted to believe Europeans have scarcely begun to profit by the inexhaustible fund of wealth contained in the New World. Europe would be inundated with the precious metals if the deposits of ore at Bolanos, Batopilas, Sombrerete, Rosario, Pachuca, Moran, Zultepec, Chihuahua, and so many other places that enjoyed an ancient and just celebrity, were assailed at one and the same time with all the means offered by the perfection to which the art of the miner has attained."

The opinion of Ward is given in the following passages: "That the great mineral treasures of Mexico commence exactly at the point where Humboldt rightly states the labors of the Spaniards to have terminated, (above latitude 24°,) is a fact now universally admitted by the native miners, although heretofore but little known in Europe. The states of Durango, Sonora, Chihuahua, and Sinaloa contain an infinity of mines hitherto but little known, but holding out, wherever they have been tried, a promise of riches superior to anything that Mexico has yet produced. * * * * In common I believe with all those who have had an opportunity of inquiring into the resources of New Spain, I do regard it so well ascertained a fact that her mineral riches are almost unexplored, that I am willing to rest upon it my whole calculation with regard to her future importance as a country." (Ward, vol. I, pp. 127-160.)

Duport expresses himself thus: "After having visited only Tasco, Real del Monte, and Guanajuato, Humboldt said 40 years ago that there was enough silver in the Mexican mines to flood the world: what would he not have said if he had pushed his researches further north? More strongly convinced than he could possibly be of the abundance of the argentiferous veins, I am not so confident about the brevity of the time within which the progress of science in Europe, and the free intercourse of all nations with Mexico, can exert any considerable influence on the amount of the production of the precious metals."‡

And again he says: "The want of capital, of political quiet, of population, and of education in the northwest of the republic, and of wide-spread scientific knowledge, and finally the high price of mercury, are the obstacles which oppose the increase of the production of the precious metal in Mexico. These causes will exercise their fatal influence for some years yet, and will prevent the yield from passing the figure which it reached at the beginning of this century. But these obstacles are not permanent in their character; they are only temporary, and will after a time be neutralized, and then overcome, by the abundance of the ore and the progress of science, which gives a wider dominion every year to the power of man. The time will come, a century sooner or a century later, when the production of silver will have no limit save that imposed by the steady decrease of its value."§

NORTHERN STATES OF MEXICO.—The late Mr. A. Rémond, whose untimely decease is an irreparable loss to science, made a tour of exploration through the northwestern States of Mexico during the years 1863, 1864, and 1865, in the course of which he carefully examined the geology of the country, and collected some valuable statistics on the subject of mines and mining. Professor J. D. Whitney, of the geological survey of California, in March, 1866, submitted to the Academy of Natural Sciences* an interesting report from Mr. Rémond. The following extracts convey a clear idea of the geological formation and general characteristics of northern Mexico. The tables accompanying the report show the extent, character, and condition of the mines:

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* Duport, p. 369. † Humboldt, p. 141. ‡ Duport, p. 380. § Duport, p. 426.

"The name of the 'Sierra Madre' is usually applied to the main range of mountains of this country, or the western border of the plateau which stretches north through the territories of the United States, forming what may be called the great orographical feature of the continent. In northwestern Mexico this crumpled border of the great plateau comprises an extensive mountainous region, by no means forming a continuous single chain, but rather several central ranges, with associated groups of parallel ridges, all having the same general course, which is approximately north-northwest and south-southeast. As the breadth of the chain widens as we go towards the north, so, too, that of the valleys increases in that direction, the whole system of mountains and valleys spreading out in something like a fan shape.

"Going north, the chain appears to sink gradually, although determinations of altitude in northern Mexico are extremely few in number. It is certain that there is, in about latitude 32°, a depression of the mountain ranges which extends entirely across the continent, and which would enable the traveller to cross from the Atlantic to the Pacific, without necessarily surmounting any elevation greater than 4,000 feet.† The southeastern range is the highest, and the culminating point is said to be the Cerro de Cuiteco, 60 leagues northeast of Jesus Maria, on the western borders of Chihuahua. The approximate altitude of the Cumbre de Basascachic is 7,429 feet, and that of Guadalupe y Calvo 7,825 feet. To the north, the ranges east of Sahuaripa are also very high; but they have never been measured. No peaks or ridges, however, in this portion of Mexico attain anything like the elevation of the higher portion of the Sierra Nevada, few if any points exceeding 10,000 feet in altitude.

"The direction of the sierra is nearly that of a line connecting some of the best mining districts in Mexico, which are situated on or very near the summit of the mountains. These districts are the following, enumerating them in their geographical order from the south towards the north: in Durango, San Antonio de las Ventanas, Guarisamey, and San Dimas, remarkable for their auriferous silver ores, and 62 Mexican leagues northeast of Mazatlan; in Chihuahua, Guadalupe y Calvo and San Pedro de Batopilas, yielding fine specimens of native silver; also, Jesus Maria, in the same State, and the Real del la Cieneguita, Sonora, with silver and gold mines.

"GENERAL GEOLOGY.—The geological structure of the occidental slope of the Sierra Madre, as well as that of other parts of this great chain, is exceedingly interesting, and, as yet but very little known, notwithstanding the valuable investigations of Humboldt and other eminent men; for, up to the present time, the age of the different formations has never been fixed with any degree of accuracy, from want of materials and of sufficient observations. In 1863, 1864, and 1865, however, I explored quite a number of localities in northwestern Mexico, and was thus enabled to obtain a pretty good general idea of the geology of that region; and, in Sonora, to which my attention was especially devoted, I succeeded in finding fossils in sufficient quantity to allow of the determination of the age of the principal formations of the northern Sierra Madre. By tracing the connection of these rocks with those of Central Mexico, additional light will be thrown on those districts of which, at present, but little is definitely known.

"The igneous rocks, which occur more abundantly on the Pacific slope, are granites, either fine or very coarse-grained; porphyries, more or less feldspathic; and greenstones, all of which are cut by numerous dikes of extremely varied character. The granites, however, are very poor in veins of the precious metals, while the porphyries are highly metalliferous. In Sinaloa (Candelero) and Durango (San Dimas) we see that the granites underlie the metalliferous porphyries, and that the greenstones, in Sonora, (near Hermosillo and in the vicinity of La Haciendita,) penetrate through them.

"The oldest sedimentary rocks which I have observed belong to the carboniferous series; this is represented in the eastern part of Sonora by heavy masses of limestone, forming very high and rugged ridges, running a little west of north. The upturned strata are seen in many places to rest on granite. Argentiferous veins occur throughout this formation.

"The next group of sedimentary rocks in order is the triassic; this forms isolated mountain groups in Sonora, and offers an interesting field for investigation. Instead of limestones, it is made up of heavy beds of quartzites and conglomerates, with coal-bearing clay shales; all of these are disturbed and elevated, and rest on greenstones, feldspathic porphyries, or granite. Wherever metamorphosed, the triassic rocks are auriferous and contain veins of silver ores. The metamorphic slates and limestones of the Altar and Magdalena districts, which include the richest gold placers of Sonora, may possibly be of triassic age; but the fossils collected are too imperfect to admit of this being determined. There are some reasons for believing those rocks to be rather of jurassic than of triassic age, as they differ in lithological characters from both the triassic and carboniferous of northern Mexico, resembling rather the jurassic gold-bearing slates of the Sierra Nevada, in California: besides, they lie outside and to the west of the Sierra Madre. It may also be noticed that the gold which they furnish does not resemble that obtained from the triassic strata.

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* Proceedings Cal. Acad. Nat. Sciences, vol. III, pp. 245-252.

† See Emory, in Mexican Boundary Report, vol. 1, p. 41.

"The cretaceous period is also represented at the foot of the Sierra Madre, at Arivechi, in Sonora. The strata belonging to this series are chiefly argillaceous shales, and they rest upon porphyries and carboniferous limestone. They have been disturbed and elevated since their deposition. The fossils, which they contain in great number and in a fine state of preservation, will be noticed further on.

"All the above-mentioned formations were already in existence before the first eruption of the volcanic rocks took place. These latter are found scattered along the whole Pacific coast, and extend from the Gulf of California up to the very summit of the Sierra. It is very interesting to see the volcanic formations spread over so extensive a region, especially as there are no active volcanoes known in northern Mexico, and not even any indications of ancient craters or vents.

"MINES.—The richest and widest veins are those northeast of Mazatlan, near San Dimas, Guarisamey, &c., in Durango. These veins cut all the rocks older than the cretaceous, whether igneous or sedimentary. The mines of Sinaloa are richer than those of Sonora. In the former state the ore-bearing portion of the veins is from a few feet to several yards in width; in the latter, generally from one to two feet. In Durango and Sinaloa, gold, native silver, and sulphuret of silver occur, associated with galena, yellow blende, and iron pyrites. In Sonora the principal ores are argentiferous gray copper, with galena, black blende, copper pyrites, arsenical pyrites, carbonate of lead, ruby silver, arsenical silver, and gold. Each mining district is characterized by a peculiar system of veins; in all as many as 20 different systems have been observed. The most abundant vein stones are quartz, either chalcedonic, crystalline, or massive; brown spar; heavy spar; oxide of iron. The veins occurring in the metamorphic triassic rocks are usually parallel with the stratification, so that they lie nearly horizontal where the formation has been but little disturbed. As to the yield of the silver ores, it varies extremely, and it would be necessary to enter into a full description of all the different districts to give an idea of it. It may be noticed, however, that the arsenical pyrites, which is auriferous in the Sierra Nevada, becomes argentiferous in the Sierra Madre. The veins vary in their direction from a little east to a little west of north; the richest ores near San Dimas run northeast and southwest. There are but few rich mines in Sonora, a state of which the mineral wealth has been much exaggerated. There are, however, some deposits of variegated copper, and veins of magnetic and specular iron.

"The annexed tabular statement will give the principal facts obtained with regard to the mines examined in northern Mexico:

Tabular statement showing the position and character of the principal mines of Northern Mexico, from 1863 *to* 1865.

BY A. RÉMOND.

Mines.	Location.	Country.	Strike.	Dip.	Width.	Matrix.	Ores.	Yield, per ton.
Noghuila	Near San Javier	Labrador porphyry	N. 35° W.	50° NE.	1½ foot	Crystalline quartz	Sulphates of zinc, lead, iron, arsenical, and copper pyrites; ruby silver and native silver.	1st class, $1,200; 2d class, $125.
Eureka	Between S. Miguelito and Los Bronces.	Greenstone	N. 45° W.	35° to 40° NE.		Quartz	Mispickel, blende, galena	
Pleiteada	Near San Javier.	Labrador porphyry	N. 30° W.	45° NE.	1½ foot	do		
San Juan	do	Quartzite, (triassic)	N. 65° E.	54° S. SE.	4 feet	Quartz and iron ore.	Galena, zinc, carbonate of lead, iron pyrites.	
Ceballos	Near Los Bronces	Labrador porphyry	N. 25° E.	85° S. SE.	2 feet	Magnetic iron		
Higuera	do	Greenstone	N. 5° E.	80° East	2½ feet	do	Copper pyrites and gray copper ore.	
La Blanca	Near San Antonio de la Huerta.	Quartzite and conglom'e, (triassic.)	N. and S.	15° East		Vesicular quartz	Gold and chloro-bromite of silver	$43
San Luis	do	Quartzite, (triassic)	N. 40° W.	35° NE.	1½ foot	Decomp. quartz & sulphate of baryta.	Blende, galena, mispickel, sulphuret of iron, and native silver.	1st class, $787; 2d class, $125.
Santa Barbara	Near Corral Viejo	Quartzite	NE. to SW.	30° SE	1½ foot	Quartz	Galena, carbonate of lead, iron pyrites, and gold.	$67 75
La Sierra	Near San Javier	Labrador porphyry	N. 60° E.	80° N. NW.	3 feet	Magnetic iron	Gray copper and iron pyrites	
San José	Near Los Bronces	do	N. 27° E.		1½ foot	Sulphate of baryta	Magnetic iron and iron pyrites	
El Socorro	do	do	N. 25° E.					
Saragosa	do	do	N. 23° E.			Magnetic iron		
San Luis Gonzaga	Near San Javier	do	N. 30° W.	30° to 40° NE.	8 inches	White quartz	Galena, blende, mispickel, and iron pyrites.	
La Colorado	Near Los Bronces	Altered sandstone & slate, (triassic.)	N. 50° E.	80° South	5 feet	Iron ore and quartz.		
Aguajito	Near San Javier	Labrador porphyry	N. 24° E.			Magnetic iron		
Santa Edubigen	La Barranca	Quartzite, (triassic)	NE. to SW.	30° NW.	2½ feet	Quartz		
La Cuadra	Near San Javier	Labrador porphyry	N. 10° W.	20° to 25° E.	1 foot	do	Arsenical pyrites, blende, and galena.	
El Rosario	do	do	N. 10° W.	20° to 25° E.		Crystalline quartz		
El Escritorio	do	do	NW. to SE.	NE	1½ foot	White quartz		
Santa Rosa	Between Los Bronces and San Javier.	Quartzite, (triassic)	N. 10° E.	55° South	3 feet	Quartz and iron ore	Carbonate of lead, iron ore, galena, blende, and iron pyrites.	
Soledad	Candelero	Porphyry, (metam.)	N. 55° E.	85° SE	30 feet	Quartz		266 65
Carmen	do	do	N. 85° E.	85° North	28 feet	do	Silver and gold, sulphate of silver.	186 65
Atocha	do	do	N. 45° E.	85° North	14 feet	do	do	213 35
Rosario	do	do	N. 50° E.	70° to 80° NW.	17 feet		do	160 00
Contrestaca	Near La Puerta	Metamorphic rocks	N. 63° E.	76° NW.		White quartz	Blende, galena, sulphate of silver	
Descubridora	do	do	N. 35° E.	69° NW.		do	do	
Soledad	Between La Puerta and San Dimas.	do	N. 65° E.	Perp		do	do	

Tabular statement showing the position and character of the principal mines of Northern Mexico, &c.—Continued.

Mines.	Location.	Country.	Strike.	Dip.	Width.	Matrix.	Ores.	Yield, per ton.
Candelaria	Near San Dimas	Porphyry, (metam.)	N. 63° E.	63° NNW		White quartz		1st class, $3,210; 2d class, $133.
Belanca	do.	do.	N. 45° E.	75° SE.	20 feet	do.	Galena, blende, gold	
Cinco De Mayo	Near Zaragoza	Sienitic granite	N. 52° E.	75° NW.	4 feet	do.	Galena, blende, iron pyrites, brittle silver glance, native silver.	1st class, $800; 2d class, $180.
Cinco Señores	Near Copála	Greenstone	N. 20° W.	45° ENE.	1 to 4 feet	Quartz	Galena, blende, iron pyrites	
Napoleon	do.	do.	N. 10° W.	80° E.	2 to 8 feet	Chalcedonic quartz	Galena, blende, copper pyrites, &c.	
Rosario	do.	do.	N. 50° W.	85° E.		do.		
Platino	do.	do.	N. 22° W.	Perp.	4 feet	do.	Galena, blende, copper pyrites	
Haval	A few leagues from Mazatlan.	Sienitic granite	N. 80° E.	80° N.		Quartz	Oxide of lead, native silver	
Mina Grande	Near San Marcial	Metamorphic slates, (triassic.)	N. and S.	30° W.	2 feet	do.	Sulphuret of antimony, mispickel, copper pyrites, blende, iron pyrites.	
Las Cruzecitas	do.	do.	N. 15° E.	63° E.	4½ feet	Heavy spar	Topustete with copper and iron pyrites, and gray copper ore.	1st class, $90 to $100; 2d class, $35 to $40.
Guijosita Vieja	Near San Javier	Labrador porphyry			?	Quartz	Galena, arsenical pyrites, blende, copper pyrites.	
La Antimonia	do.	do.				Crystalline quartz	Sulphuret of antimony and lead	
Dios Padre	Trinidad	do.			9 to 12 feet of ore.		Gray copper ore, galena, iron pyrites, native silver.	
Agua Grande	Nine miles from San Marcial.	Porphyry, (volcanic)	N. 38°–40° E.	80° NW.	1¼ foot	White quartz	Indigo copper, chrysocolla, chalkosine, chalcopyrite.	
La Colorado	Near Copála	Greenstone	N. and S.	20° W.	40 feet	Chalcedonic quartz		
Algodona	Near San Marcial	Metamorphic slates, (triassic.)	do.	30° W.	8 inches	Rotten quartz and iron ore.	Chlorobromide of silver	
Los Bronces	Los Bronces	Greenstone	E. of N.	65° E.		Heavy spar	Magnetic iron, gray copper, copper and iron pyrites.	1st class, $320; 2d class, $40 to $60.
La Prieta	do.	do.	N. 40° E.	80° NW		do.	do.	
Alta Gracia	Near San Antonio de la Huerta.	Quartzite, (triassic)	N. and S.	30° E.	4 feet	Brown spar	Copper pyrites and gray copper	
Rosario de Guadalupe	San Javier	Greenstone	N. 70° E.	60° SSE.	2 feet	Quartz	Black blende, iron pyrites, and galena.	
Aurora	Near Los Bronces	do.	N. 10° E.	45°–50° E.	2 feet	Magnetic iron	Gray copper ore and copper pyrites.	
El Taste	Near San Javier	do.	N. 15° E.	50°–55° E.	5 feet	Quartz	Galena, blende, copper and iron pyrites, (petanque.)	$100.
Providencia	Near Tecoripa	Quartzite, (triassic)	N. 10° E.	65° E.	1 ft. 2 in.	do.		1st class, $200; 2d class, $35 to $40.
La Bejorqueña	do.	do.	N. 20° E.	65° E.		Quartz, (ferruginous.)	Black blende, iron pyrites, galena, copper pyrites.	
La Chipioñena	Near Topisco	Granite						

Mina Prieta	Near San Antonio de la Huerta.	Quartzite, (triassic)				Brown spar	Copper pyrites, gray copper	
El Tesoro	Cacañhilas	Granite	NW.-SE.	75° SW.	4 feet			1st class, $220; 2d class, $90.
Rosario	Cañada de la Iglesia, near San Antonio.	Quartzite, (triassic)	NE.-SW	85° NW	9 feet		Galena and blende	$60.
Babicanora		Limestone, (carboniferous.)	NE.-SW	75° NW	5 feet	Quartz	Galena, iron pyrites, fahlers, ruby silver ore; gold and silver.	$34 65.

Mr. Cummings Cherry, geologist and mining engineer, has written an interesting report on the mineral resources of Sonora, published by the Cincinnati and Sonora Mining Association It contains a great variety of valuable information, and shows conclusively the necessity of railroad communication to develop the rich mineral resources of that country.

"At present," says Mr. Cherry, "the roads are principally the simple pack-trails of the country. From Guaymas, the port of entry, a good wagon road passes by way of Hermosillo to Ures, and thence up the Sonora river to Arispe." Another wagon road from Guaymas passes through San Marcial and Matape. Nearly the whole country, however, is traversed by pack-trails.

Referring to the miscellaneous resources of Sonora, as connected with the business of mining, Mr. Cherry gives the following data:

"TIMBER.—A valuable element in mining enterprises, and one which the western and southern districts of Sonora are very deficient in, is timber of such quantity and quality as may be desired for building purposes and fuel. The timber and lumber used in the erection of the beneficiating and other mining works of most of the American enterprises in Sonora and southern Arizona have been necessarily brought from San Francisco, and conveyed to the mines at heavy expense."

In some parts of the country the smaller kinds of timber abound in considerable quantities. At one place visited by Mr. Cherry:

"On the river margins, cottonwood, ash, willow, walnut, and sycamore of good size and quality abound. On the bottom lands, the lands formerly cultivated, is a dense forest of mesquite, so thickly matted that we were in places obliged to cut paths through it. I was surprised to find many of these trees three feet in diameter, as in other localities they seldom attain a diameter of more than six or eight inches, and with one exception this was the most extensive forest of these trees I had seen. In the tributary cañons and on the hill-sides they also occur in numbers, but smaller. This mesquite timber cannot be too highly appreciated as a fuel; it burns long and fiercely, and gives an intense heat. It is particularly valuable for charcoal, which I pronounce a superior article. On the hills are several varieties of oak, and on the higher mountain peaks, two or three leagues distant. are heavy forests of pine.

"ARABLE LANDS AND AGRICULTURAL PRODUCTS.—Two crops are raised from the same land in the year, and the yield is so abundant as to occasion astonishment to those who are unacquainted with the productive nature of these soils. The rainy season sets in early in June, and continues to October, though occasional showers fall until March. Corn and other products which require rains to bring them to maturity are planted in June, and in the latter part of November, or in December, wheat and other hardy products follow, though where, as on these lands, irrigation may be resorted to, the crops, however planted, are ever sure. The wheat of Sonora is very superior in quality; its yield is 100 to 200 bushels to one bushel sown, and it is not uncommon to get 250 to one. Corn yields large crops; the native variety is a white flint, and may be advantageously replaced with our American yellow, and other varieties. Peas ever produce three abundant crops in the year. Beans are the favorite food of the people, and as they grace alike the table of rich and poor, surprising quantities are consumed. I saw neither rice nor barley, though both may be successfully cultivated. These lands are eminently adapted to the cultivation of sugar cane, cotton, and tobacco, which are raised in the nearest settlements with excellent results. From the sugar-cane a coarse kind of sugar called *panoche* is made by the natives; it is a favorite article of consumption, and finds ready sale at $25 to $40 the cargo of 300 pounds, which leaves a handsome profit to the cultivator. Cotton is one of the most profitable products of the soil, and is becoming extensively cultivated. The staple is shorter than our cottons, though of good quality; it is manufactured by the native women into articles of wearing apparel. Tobacco also yields well; it is a profitable crop, and is becoming extensively cultivated. Besides these, Chile pepper—a capsicum of great pungency, and one of the necessaries of life with the natives—onions, garlic, melons, and sweet potatoes are produced, and our common potato and vegetables may be successfully introduced. Fruits of excellent quality could be grown, especially sweet and sour oranges, figs, quinces, and peaches; and the grape could not fail to be a decided success. Besides the valley lands on the river are those of the Henrigo valley, comprised in the timber tract already spoken of; they are exceedingly fertile, and may be irrigated from the creek which courses through them. Back from the river are several plateaus of rich soils, containing in all, perhaps, 500 acres, which, while they are too elevated to admit of irrigation, would produce abundant crops of corn in the rainy season.

"The only farming implements of the country are a pointed stick, serving for a plough, a hoe, and a sickle, and where such grand results are attained with these, what would not be the results of the introduction of our improved agricultural implements, and the application of farming knowledge?

"PASTURE LANDS.—The higher lands, unfit for agricultural uses, but covered with a growth of nutritious grasses, are adapted to cattle and sheep ranges. There are three varieties of grasses upon the lands, the mesquite grass, confined to the ranges of the mesquite timber; the sacaton, a coarse species found on the higher ranges, and the gráma (*crondosiam*,) occupying the plateaus and less elevated hills. The latter variety has much the appearance of dry, curled whittlings of pine wood, is very nutritious, and was greedily eaten by our animals. Throughout the entire year the cattle graze upon the hills, there being no need to preserve the grasses. Northern Sonora is, without dispute, pre-eminent as a stock-raising country.

"RIVERS.—The Yaqui is the largest stream in Sonora, and perhaps the only one which may be deservedly termed a river. It takes its rise in the mountains near the Arizona boundary, and flows in a southerly course.

"HARBOR OF GUAYMAS.—Our short stay at Guaymas was sufficiently protracted to impress us with the important part it must play in the future of Sonora. The town is situated on the Gulf of California, in latitude 27° 42′ north. Its harbor is eminently the best on the western coast of Mexico, being much superior to either San Blas or Mazatlan, and because of the trade winds, particularly desirable as a port for the trades of the East Indies and China. The bay consists of an inner and outer one, in all four to five miles in length, almost completely sheltered from the winds by the bold heights of Pajaros on the east, and the islands of Terra Firma, San Vicente, and Petayas on the west, leaving the channel narrow and deep between them. Another entrance, Boca Chica, occurs between Pajaros on the south and Cochin on the north. The tides are irregular, being governed by the winds of the Gulf, seldom rising and falling more than four or five feet. The depth of water is two fathoms at the mole, which is a very superior one, to eight fathoms in the channel. The town is surrounded by the irregular hills of the Coast range, through which there is but one entrance from the land side. These hills, devoid of vegetation, give the town a dreary aspect; it is small, and of modern origin, containing one spacious street, and several cross thoroughfares. In 1820 to 1825, when a free port, a considerable business was transacted with foreign ports, and it was not uncommon to find 20 or more vessels loading and unloading at one time. This activity was prematurely checked by the internal strifes of the following five years, during which it lost over two-thirds of its population. During the years 1860 to 1864 it received an impetus from the American mining and other enterprises; considerable capital was invested in town lots, and many improvements of a permanent character were inaugurated, giving to the town a population of over 5,000, and the appearance and live-awake air of a California mining town.. The present unfortunate strife and the despotic incubus of a French garrison shackled this new-born energy, and at the present writing Guaymas is in as fossilized a condition as need be. Were it not for the continual clanging of large and small bells with hoarse throats and shrieking voices, the daily occurrence of a procession of saints, images, and wax candles, the snarling of curs, the rioting of marines from some foreign war vessel. and the occasional view of a native propping up a house, or picking vermin, we would have no out-door indications from which to conclude the place was settled. With the native inhabitants, life seems to be a *dolce far niente*, or more truly, wretchedness, filth and inanity. There are a number of fine structures of the architecture peculiar to this country, and a few of American pattern. The exports are the common products of the country—wheat, corn, flour, cotton, tobacco, unrefined sugar, aguadiente, beef, hides, gold, silver, and copper; for which it imports the products of the more southern States, and East Indian and European manufacturers Its exports of products and bullion for 1865 could not have fallen short of $4,000,000, though for the present year it will hardly exceed half of this sum. The climate is pleasant from November to April; the heat in the summer months, June to September, is excessive, the mercury reaching 105° to 110°, and very seldom falling below 97° or 98°, and when the hot winds visit the town, as they often do during the summer months, it frequently reaches 135°. There is but little sickness, and what occurs is of a light character; the water which supplies the town is procured from wells sunk at the limits of the town, and is slightly brackish, though wholesome. With a harbor capable of giving good anchorage to 200 vessels, safe navigation in the Gulf, and a section of country requiring only peace, enterprise, capital, and the energy of American settlers to till the lands, and work the mines which Mexican indolence has permitted to fall into ruin, with the indomitable spirit of American advancement to make of an old country a new California, Guaymas is destined at no distant day to take her place as the grand commercial depot of western Mexico, and I would venture to predict, of our own extreme southwestern Territories."

General Rufus Ingalls, in his inspection report, (Ex. Doc. 111, 39th Cong., 2d sess., p. 9,) says:

"A harbor on the Gulf is wanted, such, for example, as Guaymas, which is nearer to the heart of Arizona than any point on the Colorado river. From Port Libertad to Tucson is only some 225 miles; from Fort Yuma it is 300. Had we possession of Port Libertad, or better, Guaymas, our posts in Arizona could be much easier and more cheaply supplied, and a great number of mines could then be worked with profit that lie idle now. This matter I am aware has received the attention of our authorities, who will probably cause a change in our boundary in proper time. I know that Generals Halleck and McDowell have both appreciated its necessity, and General Waller, who has been in Arizona, has written me a letter on the subject, which I enclose."

SINALOA.

Sinaloa is comparatively poor as a mining State. The lodes are neither large nor numerous. There are, however, several dozen mines that have paid well, and four or five that have yielded handsome fortunes to their proprietors. The Guadalupe mine at Cosala, if Ward's account of it is to be accepted, was, 40 years ago, one of the best mines in Mexico. It was very rich in gold, and the owner could obtain a thousand pounds of that metal from it every week, but he was a crotchety, miserly bigot, who refused to work his mine, refused to sell it, refused to let anybody else work it, and bred his children in ignorance and dirt.*

Such an account about a mine of which we find no information in other books should be looked upon with some suspicion, especially since Ward did not visit Cosala; but his statement that $1,000,000 had been offered for the mine by an association of foreigners is probably correct, for he was in a position to be familiar with all the sales of valuable mines in the country.

One of the most noted mines of Sinaloa is the Tajo at Rosario, which was discovered by accident about the beginning of the last century. A pious ranchero lost his rosary, and his search for it kept him out in the mountains all night. He made a fire to protect himself against the cold, and in the morning he discovered that the stones on which he had rested his wood were sparkling with silver. He claimed a mine, and called the place by the Spanish name of Rosary. It yielded large quantities of silver, and tradition says that the Rosario church, which cost $80,000, was built by a tax of one-quarter of a real on each marc (about one per cent.) of the silver extracted from the mine. This would imply that the total yield had been $8,000,000 previous to 1805, in which year the church was finished. In 1820 100 men were drowned in it, and most of the time since then it has been lying idle.

CHIHUAHUA.

Most of the mines of Chihuahua are in a basin which has no outlet to the sea. The elevation is high, the climate dry, the earth rocky and bare, and the few streams are lost in lakes or swamps which have no outlets. Some of the mines, however, are on the western slope of the Sierra Madre, and others in the basin of the Rio Grande. The principal mining districts are those of Parral, Santa Eulalia, Morelos, Jesus Maria, Guadalupe, Calvo, and Batapolis.

Parral is in the southeastern corner of the State, and its ores are abundant but poor. The lodes have rocky crests which project considerably above the low hills of the region. Water is scarce at the surface, and the mines are in a bad condition, having been long abandoned and allowed to fall in.

Batapolis has a multitude of very rich lodes. The Carmen yielded a lump of native silver weighing 425 pounds. There was so much native silver in the ores of the Pastraña mine that the drill-bars of the miners were provided with sharp chisels at one end for the purpose of cutting the metal.

Buen Suceso was another mine in which pure silver was found in large quantities. It was discovered by an Indian, who swam across the river (the Fuerte) and found the clear metal on the bank, where it had been laid bare by the water. He denounced the mine, and took out much silver, but after getting down three yards the water became so troublesome that he could go no further, and the mine was not worked while Ward was in Mexico, nor do we find any mention of it in later books.

The mines of Morelos were discovered in 1826, and yielded $270,000 in two months. Jesus Maria, on the western boundary of the State and nearly east of Guaymas, was discovered in 1822, and yielded extremely rich ore—so rich that it was packed to Parral, nearly 400 miles distant, to be reduced. Refugio was discovered shortly before the outbreak of the revolution; yielded about half a million annually for four or five years.

About 15 miles southeast of the city of Chihuahua is the district of Santa Eulalia, which produced about $100,000,000 in the course of the last century. From 1705 to 1737 the average annual yield was $1,748,742. In 1791 there were in the district 6,000 inhabitants, 73 amalgamating establishments, and 180 smelting furnaces. About 1795 the district was abandoned in consequence of the incursions of the Apaches and Comanches, and the mines remained in their abandoned condition, although there is no reason to doubt that they might be worked with great profit, if the laborers and property could be protected against the savages. Just before the district was abandoned a rich deposit found in one of the mines had been worked out, having lasted nine years, in which time it yielded so much that a tax of one real per marc (about one and a half per cent.) sufficed to build the cathedral of Chihuahua and establish for it a reserve fund of $10,000. We cannot estimate the total yield of the bonanza at less than $4,000,000.

DURANGO.

Durango is very rich in silver, but its wealth was not known until just before the revolution, and there has been comparatively little exploration since. This State, like Sonora and Chihuahua, has suffered severely from Apache incursions.

The city of Durango, 195 miles northwest of Zacatecas, had only 8,000 inhabitants in 1783, but in that year Zambrano, the great miner of that region, discovered the mines of Guarisamey, and Durango soon trebled in population. In 24 years he extracted $30,000,000 from his claims, and a multitude of other mines were opened, so that the average yield of the State was estimated to be $5,000,000.

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* Ward, volume II, page 254.

The principal mining districts are Gavilanes, Guarisamey, San Demas, Tamusula, Canelas, and Sianori, on the western slope of the Sierra Madre, and Cuencame, Guanaseir, and Mapimi on the eastern. These eastern districts are marked by the abundance of lead; the western by the abundance of gold. The lode at Gavilanes is 40 feet thick and the ore quite rich, but it is stubborn both for amalgamation and for smelting. The richest district is Guarisamey, and the most productive mines are there—Araña, Cinco, Señores, Bolaños, Piramide, Candelania, Dolores, and Tapia. The Araña mine was remarkable for having a vault (like that in Zavala mine at Catorce) filled with a fine dust, a large part of which was native gold and silver.

Ward says of Durango: "The State is rich in mineral deposits, none of which, excepting Guarisamey and San Demas, have been at all extensively worked. There is hardly a single mine exceeding 100 varas in depth; for, in general, the use of even the simplest machinery was unknown in the north, and a malicati, primitive as the invention is, would have excited almost as much astonishment as a steam engine itself. The mines were worked as long as the water could be raised, without inconvenience, by two or three tenatoris (carriers) with leather buckets, and abandoned when the discharge of this duty became too laborious. Most of the principal districts may, consequently, be regarded as virgin ground, and there are few in which the old shafts might not be again brought into activity with a comparatively small outlay." (Ward, II, page 293.)

SOUTH AMERICA.

PERU.

The silver of Peru in the present day comes chiefly from Cerro Pasco, Hualgayoc, Guamachuco, Couchuco, and Huantaya—all except the last in districts near the summit of the Andes. In the beginning of the century Cerro Pasco yielded $2,000,000 annually, Hualgayoc $560,000, Guamachuco and Couchuco each $40,000, and Huantaya $675,000. Since then the production of all these districts has decreased. The fame of Peru for mineral wealth was due mainly, for a long period, to the Potosi mines, which were transferred to Buenos Ayres in 1778, and have belonged to Bolivia since Spanish America became independent. Huantaya is in the desert of Atacama, and is remarkable for the production of immense masses of native silver, one of which, found in 1758, weighed 800 pounds.

BOLIVIA.

The town of Potosi is situated 13,200 feet above the level of the sea, 100 miles from the Pacific, and 50 miles east of the main divide of the Andes. The summit of the Potosi mountains is 15,981 feet high, and is five miles from the town. The peak is conical, with sides that rise at an angle of 45° to the horizon, reddish brown in color, and bare of vegetation. It was on the side of this mountain that a poor Indian, named Diego Hualca, while clambering after a wild goat in the autumn of 1545, caught hold of a shrub to assist him up, and it pulled out, exposing pure silver to view. A brief examination proved the existence of a rich mine, and soon Potosi obtained almost as much celebrity throughout the civilized world as did California 300 years later. That barren and bleak mountain contained the largest deposit of rich silver ore ever found in the world, and it has produced more silver than any other district. The total production from 1545 to 1803 is given by Humboldt[*] at $1,150,000,000.

The following table, showing the yield in various years, indicates the gradual changes in production:

1549	$1,549,000	1720	$1,300,000
1550	2,000,000	1745	1,850,000
1590	7,500,000	1785	3,600,000
1630	5.000,000	1830	[†]625,000
1680	3,000,000		

During the first five years large masses of ore were found yielding $10,000 per ton; in 1574 the first-class ore was worth $1,400 per ton; in 1607 the yield was about $35 per ton; and in 1790 they got very little ore that produced more than $16 to the ton. The last quarter of the XVIth century was the most prosperous period in the history of Potosi, which had then a population of 130,000 souls. The men were nearly all Indians, who were compelled to work as slaves in the mines, and probably three-fourths of the 8,285,000[‡] red men who died in the mines were sacrificed to get out the treasures that astonished the world during two centuries after the discovery made by Diego Hualca. This imposing city, the largest that has ever existed so high above the sea, needed great supplies, which could only be obtained at vast expense. For the purpose of getting water 39 artificial lakes were made by building dams across ravines and valleys in the mountain side. The silver was carried by ox-carts, by way of Tucuman, to Buenos Ayres, and not unfrequently 100 of these carts, heavily laden, were seen in a train. It was probably from this stream of silver that the river having its outlet at the same place was called the Plata, that word being the Spanish name for silver.

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[*] Chapter XI, volume III, p. 249. The amounts collected for the king's fifth, year by year, from 1556 to 1789, are given there.

[†] Temple, volume I, p. 309. [‡] Temple, volume I, p. 320.

For 30 years after the discovery of Potosi the silver was obtained exclusively by smelting in portable furnaces made of clay, in the form of hollow cylinders, with a number of holes for the admission of air. Silver ore, galena, and charcoal were put in in alternate layers, and the fierce winds which blow on the mountain side furnished a sufficient blast, and sometimes even too strong, so that it was necessary to carry the furnaces to a sheltered place. The mixed lead and silver were afterwards melted again with a blast made by a dozen Indians blowing with their mouths through copper tubes two yards long; and thus the baser metal was burned off. At one time 6,000 of these furnaces could be seen burning on the mountain side. The galena was found in the Little Potosi mountain. At the end of the XVIth century 15,000 slaves and as many llamas, and as many more mules, were employed in the labors of the mines and reduction works.

CHILI.

Chañarcello, the richest mining district of Chili, and at present the most prosperous and promising of all in South America, is situated in latitude 27° 30′, 50 miles southeastward from Copiapo. It is 50 miles from the ocean and 3,000 feet above the level of the sea to the lowest mines. The most productive deposit of silver has been found within an area a mile and a half long and a mile wide, in a cream-colored hill, all the adjacent hills being dark. It is situated on the edge of the desert of Atacama, and there is very little vegetation, and sometimes no rain for a year. The nearest water—at least the most convenient of access—is 10 miles off, and it is sold at the mines at 16 gallons for $1, but it is fit only for brutes, and the water for the men is brought further, and paid for at a higher price.

The first mine of Chañarcello was discovered on the 18th of May, 1832, by a muleteer named Juan Godoi, who, while out hunting, got tired of chasing a guanaco and sat down on a stone to rest. Happening to examine the rock, he saw that it was very rich silver ore, and he managed to break off enough to load his two donkeys, with which he went to Copiapo, where he asked the assistance and counsel of Juan Callejas, his friend and an old miner. They obtained a title to the mine, and Callejas, in recognition of many favors, transferred his share (one-third) to Don Miguel Gallo, who became one of the wealthiest men of Chili. The mine proved very productive, and Godoi, who had been a very reputable muleteer, became a low debauchee. He spent all his immense wealth, and was reduced to beggary. He had not even a donkey. Gallo took pity on him and gave him a little mine, which he sold for $14,000, and on that sum the discoverer of Chañarcello lived in moderation and quiet.

A mine called Bolados was richer than the pioneer claim, to which it was very near. It yielded $3,000,000 to four owners, and, though all were married and had children, not one of them left a cent to his heirs. All had wasted their money in riotous living. The largest piece of native silver on record was found in this mine; it weighed 6,000 pounds, and was worth $150,000. One lump of it cut out with chisels—for it could not be drilled for blasting—weighed a ton and a half.

In 1850 there were 1,750 miners in the Chañarcello district, two-thirds of them Chilenos, and the remainder foreigners, mostly from other Spanish American States. The barreteros or miners who break down the ore, received $25 per month and 20 ounces of bread, a pound of boiled beans, six ounces of wheat, and 24 figs daily, the food being supposed to be enough for an average family. The apires, or men who carry the ore upon their backs to the surface, the usual load being from 250 to 375 pounds, receive $12 per month and the same rations.

At the mouth of the mine the ore is broken with hammers into pieces of half a cubic inch and assorted. Everything that will not yield at the rate of $50 per ton was thrown to one side as not rich enough to pay for working. and of this rejected material there were piles at Chañarcello, in 1850, estimated to contain $20,000,000 of silver.

The pulverization is effected in arrastras, and the amalgamation in wooden tubs with iron bottoms. The stirring is done by four crooked iron arms fastened to a vertical shaft which revolves in the centre of the tub. There is no muller or grinding of the ore in the tub. The process requires six or eight hours.

In 1850 there were in the province of Atacama 75 productive silver mines, 198 unproductive, and 2,914 persons employed. The amount of ore extracted was 15,398,996 pounds, of which 10,480,000 were credited to Chañarcello and 3,000,000 to Tres Puntas.

At Chañarcello there were 18 productive mines and 97 that had been opened and had not paid expenses. The total yield of the 10,480,000 pounds of ore obtained at Chañarcello was $2,700,000, of which $2,100,000 was net profit.*

It would appear from this statement that the ores extracted yield on average more than $5,000 per ton. The total yield of the Chañarcello district from 1832 to 1860 is estimated at $80,000,000. The value of the silver exported from Chili was $59,931 in 1830; $761,406 in 1835; $1,381,030 in 1845; $3,555,045 in 1850.

The Tres Puntas mines were discovered in 1849, and are 7,000 feet above the sea. Water costs there six cents per gallon, and the country is still more desolate than about Chañarcello.

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* U. S. Naval Astronomical Expedition, vol. 1, p. 282.

The hill of Chañarcello is composed of regular strata, nearly horizontal, of rocks partly calcareous, and partly argillaceous. In the deepest workings there are porphyries and some dolomites. The ores are chiefly chlorides and bromides either separate or mixed.

Cerro Blanco, 30 miles east-southeast of Chañarcello, has a number of lodes which were rich in silver near the surface, but in the lower depths they yield little save copper, of which the ore has a large percentage.

Carriso, in latitude 28° 45′, has some rich silver lodes and one of gold. Eight miles southeast of Carriso is Agua Amarga, a hill resembling Bolaco, at Chañarcello, with as many argentiferous lodes, but not so rich. Most of them are now abandoned. A mile from Agua Amarga are the mines of Tunas, which yielded $400,000 of native and ruby silver near the surface.

BRAZIL.

The placers of Brazil, the richest known to modern times previous to the beginning of this century, are found over an area 300 miles wide, from north to south between parallels 17 and 22 of south latitude, in the mountains which separate the valleys of the Amazon and the La Plata, and 800 miles long, extending from the western boundary of Brazil nearly to the Atlantic. The rocks are granite in the higher peaks, with micaceous schists and slates lower down, intersected by numerous veins of quartz. Itacolumite is found extensively, and diamonds, which are seldom found near it, are abundant in Brazil, which has furnished more of those precious stones than all the other diamond mines in modern times. These are, indeed, the only diamond mines of any note in Christendom. Very little is done in them now. The gold was discovered at Minas Geraes in 1599, and soon attracted a considerable population. The gold deposits of Jacoabina and of Rio do Carmo were opened in 1700, and those of Mato Grosso in 1734. From 1752 to 1761 the production was largest, and there were then 80,000 miners employed. It is said that in one year the production was $20,000,000. It is a matter of record that the 20 per cent. tax on the gross product, or the king's fifth as it was called, for the district of Minas Geraes was $2,000,000 for 1753. In 1725, when the yield was considerably less than it became a quarter of a century later, there were 100,000 slaves at work, and it was estimated that they took out an eighth of an ounce each per day, as we learn from Southey;* but as this would give a total yield of $60,000,000 annually, we must infer that many of the slaves were employed in other pursuits, and that many of the slave miners did not make their eighth of an ounce per day. The largest Brazilian nugget of which we find any mention, weighed 13 pounds and sold for about $2,600. After 1775 the yield declined rapidly. In 1812 the production was about $4,000,000, and in 1822 $700,000, and now it probably does not exceed $500,000. The total yield of the Brazilian gold mines from the time of their discovery till 1803 was estimated by Humboldt at $855,500,000, and we may estimate the production since 1803 at $70,000,000, making the total contribution of gold by Brazil $925,500,000 in a period of 268 years: less than California has furnished in 20 years. So far Brazil has only two quartz mines, the St. John and the Gongo Soco. The latter yielded 33,000 pounds of gold from 1826 to 1849.†

Of the St. John, Whitney‡ says: "The mine of St. John del Rey is the most remarkable gold quartz mine in the world, having been worked for a longer time and having produced more gold than any other. The working was commenced about 1725, and after nearly a hundred years of success was abandoned, and in 1834 the working was resumed, and from 1838 to 1852 the mine paid a profit of $1,500,000. The amount of rock reduced was 34,000 tons in 1846, and 82,000 in 1852, the increase being gradual. The profit varied from $2 to $3 per ton. The rock contained about .004 per cent. of metal. The crushing was done with 118 stamps. The mine is owned by a company which had 1,000 slaves and employed 80 European overseers, mechanics, &c. One of the mines was 1,200 feet deep."

BRITISH POSSESSIONS.

BRITISH COLUMBIA.

The gold mines of British Columbia are in the basins of the Fraser and Columbia rivers.

The chief mining district is Cariboo, on the north side of the north fork of Quesnelle river, 100 miles above the mouth of that stream, in latitude 53°, and 100 miles from the ocean, from which it is separated by a range of mountains 8,000 or 10,000 feet high. The winters are very severe, and they last from October to June, during which period the country is covered with a deep snow. In July and August the streams are at flood height. The gold is found at a depth varying from 12 to 100 feet from the surface in the beds and banks of creeks, some of which run through swamps. The auriferous deposit is very rich, and if it were in a genial clime and favorably situated, the yield per day would rival if not surpass anything ever found in California, but the great cost of all supplies, the necessity of lying idle a large part of the year, and the difficulty of finding good claims, prevent it from being an attractive place for miners. Claims that have been well opened have, in many instances, paid for a few weeks or month $500 per day to the man. One claim 25 by 80 feet yielded $105,000. The gold on Antler creek is 830 fine; on Lowhee creek 920. The metal is found in coarse rough lumps, which look as though they had not moved far from their rocky source. Some auriferous quartz lodes have been discovered, but little has been done in quartz mining.

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* History of Brazil, chapter XXXVI. † Calvert, p. 221. ‡ Metallic Wealth, p. 111.

The gold in the basin of the Columbia is found in the beds, bars, and banks of creeks, between parallels 49° and 51′. The diggings are mostly shallow, and not rich, although, as they cover a considerable extent of country, they may in the course of a few years produce more gold than Cariboo.

The following table shows the amount of gold shipped from Victoria to San Francisco:

Year.	Am't shipped.	Year.	Am't shipped.
1858	$337,765	1863	$2,935,172
1859	1,211,304	1864	2,784,226
1860	1,652,621	1865	2,067,661
1861	1,942,629	1866	1,625,311
1862	2,167,183	1867, (9 months)	1,100,588

AUSTRALIA.

The colony of Victoria in Australia did not begin to produce gold until 1851, but the next year it had already risen nearly to a level with California, and since then the two States have kept nearly an equal pace. The following table shows the number of ounces exported annually from Melbourne, and the value as estimated in pounds sterling:

Year.	Ounces.	Value.	Year.	Ounces.	Value.
1851	145,147	£580,587	1859	2,280,676	£9,122,703
1852	2,724,933	10,699,733	1860	2,156,661	8,626,643
1853	3,150,021	12,600,083	1861	1,967,420	7,869,738
1854	2,392,065	9,568,202	1862	1,658,285	6,685,192
1855	2,793,065	11,172,261	1863	1,627,066	6,507,489
1856	2,985,696	11,942,783	1864	1,544,694	6,178,776
1857	2,761,528	11,046,113	1865	1,543,801	6,175,204
1858	2,528,186	10,112,752	1866	1,480,507	5,922,948

We have no plain description of the character of the quartz lodes and placers of Victoria, but they, especially the latter, differ from those of California. Water is far less abundant; ditches are fewer, smaller, and less costly; hydraulic claims, tunnel claims, and sluices are rarer; shaft claims are far more numerous; the character of the leads appear to be less distinct; the gold is generally coarser in size and finer in quality, and the gold-bearing strata seem to be richer. There are few placer claims in California that would pay for hoisting dirt 100 feet through shafts, and washing in puddling boxes, as is done in many Australian claims. We see no mention in Victoria books or newspapers of ancient rivers, which occupy a very prominent place in the placer mining of California.

Some of the peculiarities of placer mining in Victoria are suggested in the following extract from Westgarth:

> Alluvial mining, however, differs from quartz mining in not being mainly dependent on steam machinery. Much of it is still conducted by mere manual labor, but under appliances either new or much improved during the last 10 years. Horse-power has also been largely introduced, and it is the great motive force of the puddling machine, that grand institution of the alluvial mining world. This machine rapidly supplanted the original cradle and tub; in fact, it represents both upon a giant scale. The miner could readily apprehend that if an ordinary washing tub of three or four feet in diameter could be made to yield an ounce of gold per day, one of as many yards must, if equally well worked, yield proportionately more. The cradle arrangement was adapted to the gravel; while the tub was suited to the puddling of the finer debris, such as pipe clay or dirt beds, which were much more frequent to the miner than pure gravel. Puddling by wholesale was therefore a subject of early attention.

STATIONS OF VICTORIA.

At the end of 1866, there were 70,804 men engaged in mining, a decrease of nearly 10,000 within a year, of 27,000 since 1862, and of 54,000 since 1859; the average weekly earnings of miners were £1 11*s*., or about $7 75 each, and in 1852 they were $22 40.

The machinery employed in quartz mining consisted of 522 steam engines, with an aggregate of 9,079 horse-power; 62 water and horse-power crushing machines; 55 water wheels; 210 whims and pulleys; 6 derricks, and 74 whips.

The machinery employed in alluvial mining consisted of 451 steam engines, with an aggregate of 9,338 horse-power; 2,799 horse-puddling machines; 400 whims and pulleys; 110 whips; 621 sluices and toms; 159 water wheels; 30 hydraulic boxes; 179 pumps; 5,833 sluice boxes, and 3 boring machines.

The total estimated value of the machinery employed in mining was $9,500,000, and the claims themselves $43,000,000.

The length of the mining races, or as we call them "ditches," at the end of 1864 was 1,747 miles, and the approximate cost $941,655, or $539 per mile. In the Stanley sub-district, the races cost more than $2,000 per mile, the high average being caused partly by 14,383 yards of tunnelling.

The poorest gold was 742 fine, and sold for £3 3*s*. per ounce, and the richest was 966 fine, and sold for £4 2*s*. per ounce. The mean fineness was 854.

About one-third of the gold comes from quartz, and one-third from alluvial mines.

The total number of distinct quartz lodes proved to be auriferous is 1,700, and the area of auriferous alluvial and quartz ground worked upon is 892 square miles.

In 1864, 843,515 tons of quartz yielded 433,981 ounces, or $9 54 per ton of 2,240 pounds. This is the only quartz of which returns were obtained, though it is known that more was crushed; how much more is not shown in the reports.

The population at the end of 1865 was 410,000, the number of sheep 11,000,000, neat cattle 2,000,000; the deposits in savings and other banks £6,668,060.

The exports of wool in 1865 were 30,000,000 pounds, the number of acres cultivated 378,000; the yield of wheat nine bushels per acre on the average, an average yield of 33 bushels of maize per acre; the production of coal 585,000 tons, and the importation of wheat and flour above exports £585,000 in value. The number of miners' licenses issued in that year were 15,458, and assuming that this figure represents the number of miners, the average yield of the mines per man for the year was £75.* The wages of bricklayers, masons, and carpenters vary from $1 75 to $2 50 per day in Melbourne.

NEW SOUTH WALES.

The following table shows the exportation in ounces of the colony of New South Wales, year by year, since 1857:

Year.	Exportation.	Year.	Exportation.	Year.	Exportation.	Year.	Exportation.
	Ounces.		*Ounces.*		*Ounces.*		*Ounces.*
1851	161,880	1855	107,250	1859	293,574	1863	422,722
1852	199 500	1856	134,950	1860	355,328	1864	314,351
1853	173,960	1857	148 126	1861	403,139	1865	279,121
1854	148,900	1858	255,535	1862	584,219	1866	235,893

The gold yield in this colony decreased for three years after 1852, and then increased rapidly for seven years, and again began to decline. The decrease since 1862 is attributed by one of the Sydney newspapers to the exclusion of Chinamen from the mines, and that policy has no doubt had a very injurious effect on the production.

NEW ZEALAND.

The mines of New Zealand were opened in 1858, and produced but little for three years, and then rose rapidly in importance. The manifested exported was 187,695 ounces in 1861, and 239,722 ounces in 1862. The amount of New Zealand shipped to England by way of Melbourne was 284,118 ounces in 1863; 311,767 ounces in 1864; 216,046 ounces in 1865, and 407,394 ounces in 1866. The total exportation of 1865 was reported to be £2,226,474, equivalent to about $11,000,000.

Westgarth's Estimates.—Westgarth makes the following estimates of the total production of the Australarian gold fields, from 1851 to the end of 1863:

Year.	Victoria.	New South Wales.	New Zealand.
1851	$3,000,000	$3,000,000	....
1852	54,500,000	6,000,000	....
1853	63,000,000	5,500,000	....
1854	48,000,000	2,500,000	....
1855	57,000,000	2,500,000	....
1856	59,500,000	3,000,000	....
1857	55,000,000	3,500,000	....
1858	50,500,000	5,500,000	$500,000
1859	45,500,000	6,000,000	500,000
1860	43,000,000	7,000,000	500,000
1861	39,500,000	8,000,000	4,000,000
1862	34,500,000	12,000,000	8,000,000
1863	32,000,000	8,500,000	14,500,000
Total	584,000,000	73,000,000	28,000,000

The total annual production of the Australian and New Zealand gold mines may be estimated at $50,000,000. (Westgarth p. 345. Pounds (£) calculatad at $5 each.)

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*Melbourne Age, January 4, 1867.

RUSSIAN POSSESSIONS.

SIBERIA.

Siberia ranks third among gold-producing countries, and for a quarter of a century before the discovery of the Californian mines, ranked first. The gold mining of the Russian empire began in placers at Jekaterinburg in 1742; in 1753 quartz mines were opened at Berezov; in 1829 the placers on the western part of the Altai were opened, and in 1838 those of eastern Siberia. The production was small for a long time, averaging only about $23,000 annually of placer gold from 1814 to 1820; but after the latter year it increased with great rapidity, averaging $1,668,900 in the next decennium, and $3,860,000 in the 10 years from 1830 to 1840, and $12,200,000 for the next decennium. This is exclusive of the quartz gold, which from 1752 to 1850, amounted to $28,000,000. The yield in 1853 was estimated by Whitney at 64,000 pounds troy, or about $14,500,000. In 1862 the production was reported to be about $10,000,000.

As a gold-producing country, Russia ranks next to the United States, and the colony of Victoria, the present annual yield being about $15,000,000. The mines are all in Siberia, in the eastern slope of the Ural, and on the northern slope of the Altai mountains. The former chain runs with the meridian from latitude 45° to 67°, and is auriferous for most of its length, but its chief wealth is on the Siberian side.

The Altai chain runs nearly parallel with the equator, about latitude 50°, and the auriferous river beds and hills extend as far as 60°, or even further. The Altai reminds us of the Sierra Nevada; both chains separate high and desert table lands from districts with rich soil and abundant streams; and the side which has the streams abounds in gold, while silver is found on the other side.[*]

The climate of Siberia is very severe, and in most of the placer districts the ground is constantly frozen at a depth of three and a half feet, the cold of winter penetrating much deeper, and the thawing influence of summer only reaching to that depth. Washing is only possible between May and September, so that half the year is lost for mining purposes. The mines are owned by the government or by wealthy proprietors, and the laborers are ignorant and poor men, who bring neither intelligence nor zeal to their aid. Each laborer receives from his employer a certain ration of meal, and his money wages amount to about half an ounce of gold for a year, or something like half an ounce of silver per month—50 or 60 cents a month.[†]

The methods of placer working are not described fully in any of the authors whose books are accessible in this country; but it seems evident that the amount of earth washed is considerably less, in proportion to the number of laborers, than in the Anglo-Saxon mines. It is said that Californian modes of washing have been introduced to a limited extent in a few of the districts; but we have no account of large ditches, of deep hydraulic claims, of ancient river beds, or of various other interesting facts which mark mining in California. And yet the number of miners in Siberia is reported to be only 40,000, and if they can obtain $15,000,000 in six months they make a very fair average production, much larger than would be presumed from the cash wages of $10 or $12 per year. According to Atkinson[‡] the pay dirt at Tagilsk contains one ounce of goldin 60,000 of each, or $8 in a ton. Duport[§] says the richness in 1829 was two ounces in 100,000. In California $1 to the ton of earth in a hydraulic claim is considered rich, and many mines that do not contain more than 50 cents to the ton are worked with large profit. It is difficult, however, to make comparisons between California and Siberia in the absence of precise information in regard to the mines of the latter country. There are many places in California in which the pay dirt has yielded more than $50 to the ton of pay dirt, and in some claims where the auriferous deposit was very shallow, or where it could only be reached by deep shafts or long tunnels, or where water was very scarce, it could not be worked profitably for less than $25. One very serious drawback to mining in Siberia is the fact that the government levies a tax of 15 per cent. on the gross yield of all mines, and from 30 to 35 per cent. on all which yield more than $400,000 annually.[‖]

As to the modes of quartz mining, Erman says:

> The ore collected is poured into long troughs where water is added and it is beaten with cast-iron stampers. The current of water which continually flows on it through pipes, carries off the fine powder over the washing benches which are laid like slightly inclined terraces under the troughs, while many of the heavier grains of gold fall into the interstices of the double iron bottom of the stamping trough and are collected from time to time. As is usual with poor sand, it is often raked upwards on the benches with a wooden rake. Ores which, as here yield ore about one part in 64,000 of their weight of metal, give not more than one part in 1,000,000 to the first straining. The richest part of the product which rest upon the upper benches is well washed again in larger receptacles, as the weight prevents its being carried off, but the poorer and finer part is again exposed to the atmosphere and a second time washed on little tables to which the water is led through pipes that can be directed upon any point. The iron, some of which is from the wear of the stampers, is removed from the fine deposit by a magnet. Though the separation of the gold has been attempted by amalgamation, experience has proved that careful washing is quite as effec-

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[*] The Ural mountains are notably auriferous on the eastern or Siberian side only, and as far as surveys have gone, it would appear that one flank only of the Australian water sheds exhibit rich accumulations of gold debris, but in this case it is the western or interior side of the range. (Calvert, p. 136.)

[†] Atkinson, p. 173. [‡] Page 202. [§] Page 305. [‖] Chevalier, p. 63.

tual. Special arrangements are made for continuing this operation through the winter; the windows are carefully caulked, stoves heated by horizontal shafts running below them are prepared for thawing the frozen mud and sand, and the materials passed in to the apartment through a narrow trap in the wall or the opening of a door would sometimes lower the temperature to the freezing point in a few minutes. (Vol. 1, p. 207.)

The gold mines of Russia were opened at Iekaterinburg, on the Ural chain, in 1743, and in 1752 quartz workings were commenced at Berezov, but the Ural placers first became important in 1814. The placers of western Siberia were opened in 1829, and those of eastern Siberia in 1838. The yield is reported* as follows:

Placer gold from 1814 to 1820	1,085	pounds	troy.
Placer gold from 1820 to 1830	73,200	"	"
Placer gold from 1830 to 1840	175,460	"	"
Placer gold from 1840 to 1850	553,955	"	"
Quartz gold from 1752 to 1850	128,570	"	"

Approximate statement of the value of the total annual production of gold and silver in the principal countries of the world, during the year 1867.

[This table is extracted by permission from the unpublished report of Prof. Wm. P. Blake, upon the "Production of the Precious Metals," from data obtained at the Paris Universal Exposition. It is the result of extended investigation of the most recent statistics from all parts of the world, and although not yet complete, presents approximately, in round numbers, the value of the gold and silver production of the world.]

Country.	Value.	Country.	Value.
United States	$72,000,000	Russia	$15,200,000
British Possessions, (estimated for 1867)	3,000,000	France, Austria, Saxony, Spain, Italy, Great Britain, Norway and Sweden	10,600,000
Mexico, (estimate)	10,000,000	Borneo and the East Indies, China, Japan, and Cent'l Asia, (estimated†)	10,000,000
Central and South America, (estimated in part)	10,000,000	Africa, (estimated)	1,000,000
Australia, including New South Wales, Victoria, and Queensland	33,200,000		
New Zealand, (estimated for 1867)	6,000,000	Total	171,000,000

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*Whitney, p. 89.

†Subject to revision.

APPENDIX.

INSTRUCTIONS FROM THE COMMISSIONER OF THE GENERAL LAND OFFICE TO THE REGISTERS AND RECEIVERS.

DEPARTMENT OF THE INTERIOR,
General Land Office, January 14, 1867.

GENTLEMEN: Herewith will be found the act of Congress, approved 26th July, 1866, "granting the right of way to ditch and canal owners over the public lands, and for other purposes."

By the first section of this act all the mineral lands of the United States, surveyed and unsurveyed, are laid open to "all citizens of the United States, and to those who have declared their intention to become such, subject to statutory regulations," and also "to the local customs or rules of miners in the several mining districts not in conflict with the laws of the United States."

It therefore becomes your duty, *in limine*, to acquaint yourselves with the local mining customs and usages in the district in which you may be called upon to do those official acts which are required by law, whether the same are reduced to authentic written form, or are to be ascertained by the testimony of intelligent miners, which you are to obtain as occasion may require and justify, in acting upon individual claims, a perfect record whereof is to be carefully taken and preserved by the register and receiver, and to be accompanied by a diagram or plat fixing the out boundaries of the district in which such customs and usages exist.

The second section of the act declares that "whenever any person or association of persons claim a vein or lode of quartz or other rock in place, bearing gold, silver, cinnabar, or copper, having previously occupied and improved the same according to the local customs or rules of miners in the district where the same is situated, and having expended in actual labor and improvements thereon an amount of not less than one thousand dollars, and in regard to whose possession there is no controversy or opposing claim, it shall and may be lawful for said claimant, or association of claimants, to file in the local land office a diagram of the same, so extended *laterally* or otherwise, as to conform to the local laws, customs, and rules of miners, and to enter such tract and receive a patent therefor, granting such mine, together with the right to follow such vein or lode with its dips, angles, and variations, to any depth, although it may enter the land adjoining, which land adjoining shall be sold subject to this condition."

Mining claims may be entered at any district land office in the United States under this law by any person, or association of persons, corporate or incorporate. In making the entry, however, such a description of the tract must be filed as will indicate the vein or lode, or part or portion thereof claimed, together with a diagram representing, by reference to some natural or artificial monument, the position and location of the claim and the boundaries thereof, so far as such boundaries can be ascertained.

First. In all cases the number of feet in length claimed on the vein or lode shall be stated in the application filed as aforesaid, and the lines limiting the length of the claim shall, also, in all cases be exhibited on the diagram, and the course or direction of such end lines, when not fixed by agreement with the adjoining claimants, nor by the local customs or rules of the miners of the district, shall be drawn at right angles to the ascertained or apparent general course of the vein or lode.

Second. Where, by the local laws, customs, or rules of miners of the district, no surface ground is permitted to be occupied for mining purposes except the surface of the vein or lode, and the walls of such vein or lode are unascertained and the lateral extent of such vein or lode unknown, it shall be sufficient, after giving the description and diagram aforesaid, to state the fact that the extent of such vein or lode cannot be ascertained by actual measurement, but that the said vein or lode is bounded on each side by the walls of the same, and to estimate the amount of ground contained between the given end lines and the unascertained walls of the vein or lode; and in such case the patent will issue for all the land contained between such end lines and side walls, with the right to follow such vein or lode, with all its dips, angles, and variations, to any depth, although it may enter the land adjoining: *Provided*, The estimated quantity shall be equal to a horizontal plane, bounded by the given end lines, and the walls on the sides of such vein or lode.

Third. Where, by the local laws, customs or rules of miners of the district, no surface ground is permitted to be occupied for mining purposes, except the surface of the vein or lode, and the walls of such vein or lode are ascertained and well known, such wall shall be named in the description, and marked on the diagram, in connection with the end lines of such claims.

Fourth. Where, by the laws, customs, or rules of miners of the district, a given quantity of surface ground is fixed for the purpose of mining or milling the ore, the aforesaid diagram and description in the entry shall correspond with and include so much of the surface as shall be allowed by such laws, customs, or rules for the purpose aforesaid.

Fifth. In the absence of uniform rules in any mining district limiting the amount of surface to be used for mining purposes, actual and peaceable use and occupation for mining and milling purposes, shall be regarded as evidence of a custom of miners authorizing the same, and the ground so occupied and used in connection with the vein or lode, and being adjacent thereto, may be included within the entry aforesaid, and the diagram shall embrace the same as appurtenant to the mine.

Where the claimant or claimants desire to include within their entry and diagram any surface ground beyond the surface of the vein, it shall be necessary, upon filing the application, to furnish the register of the land office with proof of the usage, law, or custom under which he or they claim such surface ground, and such evidence may consist either of the written rules of the miners of the district, or the testimony of two credible witnesses to the uniform custom or the actual use and occupation as aforesaid, which testimony shall be reduced to writing by the register and receiver, and filed in the register's office, with the application, a record thereof to be made as contemplated under the first head in the foregoing.

By the third section of the act, it is required that upon the filing of the diagram, as provided in the second section, and posting the same in a conspicuous place on the claim, with notice of intention to apply for a patent, the register shall publish a notice of the same in a newspaper nearest the location of said claim which notice shall state name of the claimant, name of mine, names of adjoining claimants on each end of the claim, the district and country in which the mine is situated, informing the public that application has been made for a patent for same; the register also to post such notice in his office for ninety days.

Thereafter, should no adverse claim have been filed, and satisfactory proof should be produced that the diagram and notice have been posted in the manner and for the period stipulated in the statute, it will become the duty of the surveyor general, upon application of the party, to survey the premises, and make plat thereof, indorsed with his approval, designating the number and description of the location, the value of the labor and improvements, and the character of the vein exposed. As preliminary to the survey, however, the surveyor general must estimate the expense of surveying, platting, and ascertain from the register the cost of the publication of notice, the amount of all of which must be deposited by the applicant for survey with any assistant United States treasurer, or designated depositary in favor of the United States treasurer, to be passed to the credit of the fund created by "individual depositors for the surveys of the public lands." Duplicate certificates of such deposits must be filed with the surveyor general for transmission to this office, as in the case of deposits for surveys of public lands under the 10th section of the act of Congress approved May 30, 1862, and joint resolution of July 1, 1864.

After the survey thus paid for shall have been duly executed, and the plat thereof approved by the surveyor general, designating the number and the description of the location, accompanied by his official certificate of the value of the labor and improvements, and character of the vein exposed, with the testimony of two or more reliable persons, cognizant of the facts on which his certificate may be founded, as to the value of the labor and improvements, the party claiming shall file the same with the register and receiver, and thereupon pay to the said receiver $5 per acre for the premises embraced in the survey and shall file with those officers a triplicate certificate of deposit, showing the payment of the cost of survey, plat, and notice, with satisfactory evidence, which shall be the testimony of at least two credible witnesses, that the diagram and notice were posted on the claim for a period of ninety days, as required by law, and as contemplated in the foregoing. Thereupon it shall be the duty of the register to transmit to the General Land Office said plat, survey and description, with the proof indorsed as satisfactory by the register and receiver, so that a patent may issue if the proceedings are found regular, but neither the plat, survey description, nor patent shall issue for more than one vein or lode.

The unity of the surveying system is to be maintained by extending over the mining districts the rectangular method, at least so far as township lines are concerned.

The contemplated surveys of the mineral lands will be made by the district deputies, under contracts, according to the mode adopted in the survey of the public lands and private land claims, embracing in them all such veins or lodes as will be called for by claimants entitled to have them surveyed.

In consideration of the very limited scope of surveying involved in each mining claim, the per mileage allowed by law may not be adequate to secure the services of scientific surveyors, and hence the necessity of resorting to a per diem principle, it being the most equitable under the circumstances.

The surveyor general is therefore hereby authorized to commission resident mineral surveyors for different districts, where isolated from each other, and absolutely inconvenient for one surveyor promptly to attend to the several calls for surveying in such localities, the compensation not to exceed $10 per diem, including all expenses incident thereto. Such surveyors shall enter into bonds of $10,000 for the faithful performance of their duties in the survey of such claims as the surveyor general may be required to execute in pursuance of the aforesaid law and these instructions.

The fourth section contemplates the location and entry of a mine upon unsurveyed lands, stipulating for the surveys of public lands to be adjusted to the lines of the claims, according to the location and possession and plat thereof. In surveying such claims, the surveyor general is authorized to vary from the rectangular form to suit the circumstances of the country, local rules, laws, customs of miners. The extent of the locations made from and after the passage of the act shall, however, not exceed 200 feet in length along the vein for each locator, with an additional claim for discovery to the discoverer of the lode, with the right to follow such vein to any depth, with all its dips, variations and angles, together with a reasonable quantity of surface for the convenient working of the same as fixed by local rules: *Provided*, no person may make more than one location on the same lode, and no more than 3,000 feet shall be taken in any one claim by any association of persons

The deputy surveyers should be scientific men, capable of examining and reporting fully on every lode they will survey, and to bring in duplicate specimens of the ore, one of which you will send to this office, and the other the surveyor general will keep, to be ultimately turned over with the surveying archives to the State authorities.

The surveyors of mineral claims, whether on *surveyed* or *unsurveyed* lands, must designate those claims by a progressive series of numbers, beginning with No. 37, so as to avoid interference in that respect with the regular *sectional* series of numbers in each township; and shall designate the four corners of each claim, where the side lines of the same are known, so that such corners can be given by either trees, if any are found standing in place, or any corner rocks exist in place, or posts may be set diagonally and deeply imbedded, with four sides *facing* adjoining claims, sufficiently flattened to admit of inscriptions thereon; but where the corners are unknown, it will be sufficient to place a well-built solid mound at each end of the claim. The beginning corner of the claim nearest to any corners of the public surveys is to be connected by course and distance, so as to ascertain the relative position of each claim in reference to township and range when the same have been surveyed; but in those parts of the surveying district where no such lines have as yet been extended, it will be the duty of surveyors general to have the same surveyed and marked, at least so far as standard and township lines are concerned, at the per mileage allowed, so as to embrace the mineral region, and to connect the nearest corners of the mineral claims with the corners of the public surveys.

Should it, however, be found impracticable to establish independent base and meridian lines, or to extend township lines over the region containing mineral claims required to be surveyed under the law, then, and in that case, you will cause to be surveyed in the first instance such a claim, the initial point of which will start either from a confluence of waters, or such natural and permanent objects as will unmistakably identify the point of the beginning of the survey of the claim upon which other surveys will depend.

Section 5 provides that in cases where the laws of Congress are silent upon the subject of rules for working mines, respecting easements, drainage, and other necessary means to the complete development of the same, the local legislature of any State or Territory may provide them, and in order to embody such enactments into patents you are directed to communicate any such laws to this office.

Section 6. Should adverse claimants to any mine appear before the approval of the survey, all further proceedings shall be stayed until a final settlement and adjudication are had in the courts of the right of possession to such claim, except where the parties agree to settlement, or a portion of the premises is not in dispute, when a patent may issue as in other cases.

Section 7 provides for such additional land districts as may be necessary.

Section 8, for the right of way.

Section 9, for protection of rights to the use of water for mining, agricultural, manufacturing, or other purposes; for the right of way for the construction of ditches and canals; and makes parties constructing such work (after the passage of this act,) to the injury of settlers, liable in damages.

Section 10. Homesteads may, prior to the passage of this act, by citizens of the United States, or persons who have declared their intention to become citizens, but on which lands no valuable mines of gold, silver, cinnabar, or copper have been discovered, are protected, so that settlers or owners of such homesteads shall have a right of pre-emption thereto, in quantity not to exceed 160 acres, at $1 25 per acre, or to avail themselves of the homestead act and acts amendatory thereof.

Section 11 stipulates that upon the survey of the lands in question the Secretary of the Interior may set apart such portions as are clearly agricultural, and thereafter subjects such agricultural tracts to pre-emption and sale, as other public lands.

In order to enable the department properly to give effect to this section of the law, you will cause your deputy surveyors to describe in their field notes of surveys, in addition to the data required to be noted in the printed Manual of Surveying Instructions, on pages 17 and 18, the agricultural lands, and represent the same on township plats by the designation of "agricultural lands."

It is to be understood that there is nothing obligatory on claimants to proceed under this statute, and that where they fail to do so, there being no adverse interest, they hold the same relations to the premises they may be working which they did before the passage of this act, with the additional guarantee that they possess the right of occupancy under the statute.

The foregoing presents such views as have occurred to this office in considering the prominent points of the statute, and will be followed by further instructions as the rulings in actual cases and experience in the administration of the statute may from time to time suggest.

Very respectfully, your obedient servant,

JOS. S. WILSON, *Commissioner.*

U. S. Registers and Receivers and Surveyors General.

SUPPLEMENTARY INSTRUCTIONS.

Department of the Interior, General Land Office, *June* 25, 1867.

Gentlemen: In the preparation of forms adapted to the purchase of mineral interests under the act of July 26, 1866, it is found necessary, in connection with circular of January 14, 1867, to direct your attention to the following:

1st. Where the rules of miners do not permit ground to be occupied, except the surface of the vein or lode, the claims presented may contain less than an acre of ground. In such cases, as we do not, in regard to rates, deal with a fraction, the price of $5 is to be paid for the same; if the area exceeds that quantity, $10; if more than two acres, $15, and so on.

2d. In applications for mineral claims it will be necessary, where a claim contains *less* than one acre, that the agreement expressed should be to pay $5 for the claim.

3d. Should a party appear as an "adverse claimant," as contemplated by the 6th section of the act, you will require such person to show by proof the claim or interest he may have in the mine; and should the same be satisfactory to you, all further proceedings will be stayed until a final settlement and adjudication shall be had in the courts. But in case the adverse claimant, after proceedings have been stayed, shall fail to institute action in the courts, either pending or at their next ensuing session, with a view to the final adjustment of the claims, you will proceed with the case as if no objections had been filed.

4th. You will enter all claims under the act in separate tract-books from those used for agricultural lands, dividing the books into townships and ranges, allowing about eight pages to each township.

For the present you will use the blank form of Abstracts of Land Sold and Register of Receipts in reporting returns, making such slight alterations in the headings as the cases may demand. Should it be found advisable in the future to have special abstracts, forms will be prepared and printed and a supply duly transmitted to you.

You will commence a new series of numbers with the certificates—beginning with No. 1—and continue the same in regular order. As no special fee is provided for in the statute, you will be allowed one per cent. each on amount of purchase-money, as in cash sales. The moneys received for these claims will be accounted for in the receiver's returns as cash received for sale of mineral claims.

Forms of applications, certificates, and receipts are being printed, and a supply will be sent as soon as possible.

I also append an abstract of duties prescribed in instructions of 14th January, 1867.

Very respectfully,

JOS. S. WILSON, *Commissioner.*

Register and Receiver.

Abstract of Duties.—The following is an abstract of the duties prescribed in mineral instructions of January 14, 1867:

Claimant.—To post a notice on the claim giving information of his intention to apply for a patent; to file a diagram with the register, together with the evidence of the rules of miners in support of the claim and its extent. After the diagram and notice have been posted 90 days, and no adverse claim filed, the claimant to apply to surveyor general for survey of the claim, deposit the amount estimated by the surveyor general to cover the expenses of the survey, platting, and notice with any assistant United States treasurer or designated depository in favor of the United States Treasurer, to be passed to the credit of the fund created by "Individual Depositors for the Surveys of the Public Lands," taking duplicate certificate of deposit—filing one with surveyor general, to be sent to the General Land Office, and retaining the other; and when the survey is approved and diagram thereof, together with the surveyor general's certificate as to improvements and character of the vein exposed, the claimant to pay to the receiver the price of the claim.

Register and Receiver.—To examine testimony filed by claimant showing the applicability of miners' rules in reference to the extent of the claim, which testimony is to be reduced to writing and filed with the claimant's application in the register's office; also to examine the returns of survey approved by the surveyor general and filed by the claimant.

Receiver.—To receive from the claimant the price of the claim on his filing with the register and receiver the approved plat and certificate of the surveyor general as to the value of the improvements and character of vein exposed, based on testimony by two reliable witnesses.

Register's diagram of the claim being filed by the claimant, the register shall publish a notice in a newspaper nearest to the claim, naming the mine, claimant, adjoining claimants, district, and county, informing the public that application has been made for a patent. The register will post the notice in his office for 90 days, and on the publisher's presenting his account to the register immediately on the expiration of the 90 days, he will transmit it to the surveyor general; and on the receipt from the claimants of the surveyor general's certificate of the improvements on the claim, together with plat and other evidences of the survey approved, also the receiver's receipt for the payment for the claim, the register will transmit same, with proof, indorsed by register and receiver as satisfactory, to the Commissioner of the General Land Office for patent.

Surveyor General's duty when no adverse claim is filed, proof furnished that the diagram and notice had been posted for 90 days, and on receiving, also, from the register the account of the publisher of the notice: The surveyor general, when applied to by the claimant for the survey of his claim, shall estimate the expense of the survey, platting, and notice, and when a certificate of deposit is filed with him by the claimant, he shall order the survey to be made, and transmit the certificate of deposit to the General Land

Office. When the returns of survey are made to the surveyor general's office he will approve the same, hand the necessary evidence thereof to the claimant, to be filed by him in the register and receiver's office for examination and final preparation of patent-certificate by the register for transmission to the Commissioner of the General Land Office. The surveyor general will also transmit returns of the survey to the Commissioner, with the account of the surveyor and that of the publishers of the notice, for direct payment from United States treasury to parties entitled, as in the case of payments made out of the funds deposited under the 10th section of the act of Congress approved May 30, 1862, and joint resolution of June 1, 1864.

Legislation in regard to the Mineral Interests.—The Commissioner of the General Land Office, in his annual report for 1866, gives the following condensed summary of the legislation by Congress in regard to the mineral interests:

The mineral interests in the public lands have been the subject of legislation during a period of 81 years. The ordinance of 20th of May, 1785, reserved one-third part of all gold, silver, lead, and copper mines; the act of 3d of March, 1867, dealt with lead mines; the enactment of 3d of March, 1829, authorized their sale in Missouri; the pre-emption act of 4th of September, 1841, excluded from its provisions known salines or mines; the act of July 1, 1864, requires coal lands which, as mines, are excluded from the pre-emption of 1841, to be offered at $20 minimum, making them pre-emptible at that rate.

In the case of the United States *vs.* Gear, 3 Howard, 1845, it was held that it was not intended to subject lead mines to ordinary sale or pre-emption in certain districts created by act of 26th of June, 1834.

In Attorney General's opinion, dated April 18, 1846, respecting mineral lands on Isle Royal, in Lake Superior, it was stated that "salines, gold, silver, lead, and copper mines" were reserved for "future disposal of Congress."

The act of July 11, 1846, required the lead mines in Illinois, Arkansas, Missouri, and Iowa to be offered, interdicting pre-emption until after offering, and then at a minimum of $2 50 per acre, but if not taken at private entry within a year of the public sale, to be subject to sale as other lands.

The act of 1st of March, 1847, in creating the Lake Superior district and directing geological survey, authorizes the sale of lands containing "copper, lead, or other valuable ores," with $5 per acre minimum.

The act of 3d of March, 1847, for organizing the Chippewa district, Wisconsin, and also authorizing geological survey, awards the privilege of purchase, at $5 per acre, to occupants at the date of the law, the supervision of mines, by act of 3d of March, 1849, having been transferred to the Secretary of the Interior.

In opinion of 28th of August, 1850, the Attorney General held that lands containing "iron ore merely" are not the "mineral lands" referred to in the 2d section of said act of 1st of March, 1847.

By the law of 26th of September, 1850, mineral tracts in Lake Superior and Chippewa districts were to be disposed of as other public lands.

The act of September 27, 1850, creating the office of surveyor general of Oregon and making donations, excludes "mineral lands" or reserved salines. By the treaty of 1851 with Peru, Peruvians are allowed to work for gold in California; the third section of act March 3, 1853, for the surveys in that State allowing only "township" lines to be extended over lands mineral or unfit for cultivation; the sixth section excepting mineral tracts from pre-emption.

The act of July 22, 1854, establishing the offices of surveyors general of New Mexico, Kansas, and Nebraska, excludes from the privileges it concedes to individuals "mineral or school lands, salines, military or other reservations."

The Attorney General's opinion of February 14, 1860, states that Congress had not then made any provision concerning mineral lands in California, except reserving from pre-emption and donation.

The act of July 1, 1864, for the disposal of coal land and town property, allows coal lands not liable under past legislation to ordinary private entry to be taken or pre-empted at $20 minimum per acre.

The act of July 4, 1866, giving authority for varying surveys in Nevada from "rectangular form to suit the circumstances of the country," reserves from sale, "in all cases, lands valuable for mines of gold, silver, quicksilver, or copper."

The last and most important expression of the public will in these respects is found in the act of Congress approved July 26, 1866, chapter CCLXII, which declares that "the mineral lands of the public domain, both surveyed and unsurveyed," are "to be free and open to exploration and occupation by all citizens of the United States, and those declaring their intention to become citizens, subject to such regulations as may be prescribed by law," and "subject, also, to the local customs or rules of miners in the several mining districts, so far as the same may not be in conflict with the laws of the United States."

IMPORTANCE OF A NATIONAL SCHOOL OF MINES.

At no period in our history has there existed a greater necessity for an increase in the production of bullion than at present. The ablest intellects of the country have been for some time past directed to the subject of our financial condition. Already numerous schemes have been presented to Congress for the maintenance of our credit at home and abroad, and various projects having in view a reduction of the burden of taxation will doubtless be discussed during the present session. Considering the great importance of the mining interest in this connection, it seems singular that the annual decrease in our product of bullion for the last few years has attracted so little attention. According to a statement in the President's message, "the production of precious metals in the United States from 1849 to 1857, inclusive, amount to $579,000,000; from 1858 to 1860, inclusive, to $137,500,000; and from 1861 to 1867, inclusive, to $457,500,000—making the grand aggregate of products since 1849, $1,174,000,000." This estimate certainly does not exceed the amount actually produced.* But the returns of the principal mining States and Territories will show that for several years past there has been a gradual decline.

Thus California produced in 1853 as high as $57,330,030, as shown by the manifest of bullion export from San Francisco. The actual production for that year probably exceeded $60,000,000. In 1865 the yield was $30,986,530; in 1866, $26,500,000; and in 1867, as estimated, $25,000,000. Nevada, a silver-producing State, has increased somewhat during the past three years, but all the other mining States and Territories have fallen off. The best authorities estimate the yield of Montana as follows: 1862, $500,000; 1863, $8,000,000; 1864, $13,000,000; 1865, $14,500,000; 1866, $16,500,000; 1867, 12,000,000. The maximum estimate for Colorado in 1863 was $9,000,000; in 1864, $6,000,000; in 1865, $4,500,000; in 1866, less than $3,000,000; and the probable yield for 1867 will not exceed $2,500,000. The product of Idaho for 1866 is estimated by good authorities at $8,000,000. This year (1867) it scarcely exceeds $6,000,000. Arizona now produces comparatively nothing. Notwithstanding these discouraging facts, so far from any diminution in the source of supply, recent explorations have developed the fact that our great mineral belts extend over a much larger area than was ever before supposed. The supply, in short, is inexhaustible. As yet it has scarcely been tapped. Why, then, should our annual product be on the decline? Because, in the first place the surface diggings very soon yield their maximum, and can never be relied upon as a permanent source of supply; and in the next, vein or quartz mining is of slow development, and requires capital and skill.

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* The special commissioner, in his letter to the Secretary of the Treasury, (p. 6,) estimates the total product at $1,255,000,000.

Assuming our total yield for 1867 to be, in round numbers, $75,000,000, and the average loss arising from imperfect systems of reduction to be 25 per cent., we have a total loss on gold and silver combined of $25,000,000. By the judicious application of science to the business of mining, and especially to the treatment of the ores, at least $15,000,000 of this amount might be saved. But this statement of loss is confined to ores actually taken out of the ground and worked. No account is taken of the vast quantity of ore cast aside as too poor to justify the expense of working under the present costly methods, or of the innumerable mineral lodes now practically valueless, which, in any country possessing first-class mining schools, would be inexhaustible sources of wealth. Nor does the estimate embrace the immense losses to which miners are subject from the erection of unsuitable machinery and from ignorance of the chemical composition of the ores and the process of reduction applicable to each class. The same ores are worked by different systems in mills located within a stone's throw of each other, and yet no record is kept of the depth from which they are taken, what the yield is by one system as compared with another, or under what combination of circumstances the best results are obtained. On the Comstock lode 500 tons of ore, it is said, are worked daily with the aid of blue vitriol and salt, at an expense for these two articles alone of $118,800 per annum. Some mills use double as much on the same kind and quantity of ores as others. Who can tell the result? Both cannot be right, and yet the mine and mill owners have a direct pecuniary interest in knowing why and to what end these things are done.

With all the experience gained in the treatment of silver ores since the discovery of the Comstock lode, there are still many important questions to be solved. This can only be done by experiments systematically conducted, and by repeated and careful comparisons of practical results. Among the subjects for investigation, and the questions which either cannot be or have not been determined by private enterprise, are the following, submitted by the distinguished metallurgist, Mr. Guido Küstel:

1. Whether the use of blue vitriol in iron pans, for the purpose of decomposing silver ores, is necessary; and, if so, in what proportion, and with reference to what silver combinations? Gould & Curry mill alone spent $17,588 for blue vitriol, in 1866, on 36,000 tons of ore. The same mine expended $35,000 for quicksilver. A great part of the loss in quicksilver is due to the use of blue vitriol. The question is, whether this loss was justified by the gain in silver, and to what extent that gain resulted from the chemical action of the vitriol on sulphurets? There are no figures to solve this problem. Taking the low estimate of 500 tons of Comstock ore worked daily with the use of blue vitriol and salt, and comparing the consumption of these chemicals in the Gould & Curry mills with the total consumption upon that basis, for a year's manipulation of 300 days, it would be equal to 150,000 tons, worked at an expense of over $118,800 for the vitriol and salt alone. Now, it is more than probable that a careful investigation of the subject would result in the saving of two-thirds of this expense. Some mills use twice as much vitriol and salt as others on the same kind of ore, taken from the same depths and sometimes from the same mines. Both cannot be right. The product alone does not determine the question. Expense must be considered; but at present there is no comparison of results, nor is there any way of arriving at the facts from the books of the mills.

2. Whether the addition of salt for the same purpose is required? Gould & Curry expended for this article alone, in 1866, $10,943. Contradictory views are entertained on this subject, but there is no exact data upon which to determine the question satisfactorily.

3. Whether the iron pan decomposes silver ores for itself, without quicksilver; and, if it does, what kind of silver ores?

4. Which process of amalgamation for silver ore is, for the length of time and expense, most economical—barrel or pan amalgamation? and what is the loss of quicksilver in both cases, and the comparative loss in each?

5. To determine which of the various methods of extracting gold from its ores now or heretofore practiced in the United States is the best, and whether better methods exist in Europe, South America, Mexico, or elsewhere.

6. What method of concentration is most proper and economical with reference to different ores; what machines are best; what is the comparative efficiency of different machines and inventions? What is the motive power required, and the wood and water consumption of each? In Austria, under authority and at the expense of the government, special attention is given to the solution of all such questions as these; also, to some extent, in Saxony. The best and only work on concentration was published in Vienna; another is in course of preparation at Freiberg. No independent work of this kind, devoted specially to this subject, exists in the English language.*

The Hale & Norcross mine, one of the best managed on the Comstock lode, had a lot of 15,639 tons of ore worked at 14 different mills during a portion of the past and present year, the assay value of which, according to their books, was $465,190 in gold; $922,942, silver;

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*Mr. Küstel has since published at San Francisco a very able and elaborate work on Concentration.

total, $1,288,132; amount produced, $397,157, gold; $419,819, silver; total, omitting fractions, $816,975; loss, $471,155. [See section XVII, table No. 2, p. 376.] This is a favorable example of the work done on the Comstock lode. Not more than 65 per cent. is saved on an average of all the ores worked. The returns indicate a yield this year of at least $17,000,000. A loss of 35 per cent. would be $9,353,846. This is remarkable on a single lode. No nation on earth can furnish such an example of extravagance. The percentage of loss on gold throughout the Pacific States and Territories is not so great as on silver, but it is quite sufficient to merit the most serious consideration.

The experts engaged in our mines are nearly all foreigners; we send our young men to the schools of Freiberg, Berlin, Paris, Schemnitz, and elsewhere in Europe, to learn that which they could much better learn at home, if we had institutions equally thorough and comprehensive. And why should we not have such institutions? Our mineral resources are of far greater magnitude and value than those of any other country. Are we, a progressive people in all other respects, to lack in this? Whilst we are losing 35 per cent. of the product of our richest mineral lode by inefficient systems of working, the entire loss in amalgamation, according to Inspector Winkler, in the treatment of the Freiberg ores—which are far poorer and more rebellious than those of the Comstock—ranges from five to nine per cent. Allowing for the difference in the cost of labor and material, and for the higher rates of interest on capital in our country, this shows a remarkable contrast between the results of misdirected energy and the judicious application of science to the practical details of mining and metallurgy.

Mr. Rossiter W. Raymond,* editor of the American Journal of Mining, says:

> Statesmen recognize the fact that many things must be done by the government which would otherwise not be done at all; that the interests of education, industry, and commerce in every part of a nation are of vital importance to the whole people, and that a wise discretion in such matters is better than blind adherence to any political rule. Of course, it is difficult to draw the line between judicious and injudicious legislation in these directions. It is always easier to be consistent than to be wise. There is no general standard which can be applied; every case must be judged upon its own merits, and full and thorough discussion must give the answer to two all-important questions: first, is the proposed end one which concerns the whole nation, or only a part of it? and second, can the benefit desired be obtained as well, or at all, by local legislation or individual enterprise?
>
> Mining and agriculture are the two productive industries upon which the wealth of the world is based. Strictly speaking agriculture is the most important, since without it men could not exist; yet mining is almost as essential, since without it there could be no civilization, and men would only exist as savages. There is this difference between the two, that the products of mining are, in general, far more imperishable, and, in proportion to their first cost, of greater, because of more prolonged, use to mankind. After centuries of tilling the soil, men have no more to eat than at first, and bad crops bring famine and distress. The benefits of mining, on the other hand, are cumulative and perpetual. Who can estimate the blessings diffused by a ton of iron, mined, smelted, cast or wrought into forms of beauty and usefulness, serving for generations the needs of men, and repeatedly reforged, and reappearing, as by a material metempsychosis to enter upon new periods of beneficence? More difficult still is it to measure the importance of gold and silver, the production of which, aside from their intrinsic value and their application in the arts, is so subtly connected with the profoundest problems of commerce and political economy. Philosophers tell us that if we produce and manufacture largely, it is no matter whether we have plenty of money or not; money is nothing but a medium of exchange, and, when it is scarce, prices will be nominally low, while an increase of money nominally raises them, without altering the real relations of labor and wealth. But history and daily experience tell a different story. They show us that the world's accepted medium of exchange must bear a certain relation to the world's amount of business; and that, in spite of all contrivances of credit, barter, and paper money, the supply of the precious metals is of vital importance to all commercial nations. This conviction is the source of the universal principle of law that the mineral resources of a country, especially its mines of gold and silver, are the property of the whole country—represented in some states by the crown, and in others by the general government. We have no fault to find with the American doctrine on that subject, which throws open to individual enterprise these sources of national wealth, but it is a question whether individuals should be allowed to ruin, by ignorant and wasteful management, the endowment which nature has established for succeeding ages as well as the present, and of which, in a certain sense, we are the trustees for posterity. It is by no means indifferent to us all, whether the mines of the West are skilfully and economically worked or not, whether $9,000,000 of silver a year are lost, never to be recovered, by the methods of treating the ores of the Comstock lode, whether five dollars are wasted for every dollar extracted from the sulphurets of Colorado. These losses are so much robbery of our children; and it is eminently within the province of the government to preserve the mineral resources of the country, just as it will be imperatively called upon, before many years have passed, to prevent the destruction of its timber. Statistics show that, for several years, our production of gold and silver has been declining. There is no great cause for alarm in this fact alone. The years of greatest production were those in which superficial deposits were worked by rude methods, and since that time the business of mining has grown more difficult and expensive, while the number of miners has grown smaller. It is not the diminished production, but the increased waste, which is alarming. All the indications are that individual mine owners will not, or cannot, reform this evil. They lack the necessary knowledge, and the means of obtaining it. In vain our young men crowd the excellent schools of Paris, Freiberg, and Berlin. They need years of instruction here to make their European education available; for those branches of metallurgy which are most widely practiced in this country are the ones most scantily known and taught in Europe.
>
> Information is the least debt which the government owes to its citizens engaged in this work. And there is a special reason why this information should be nationally given. The difficulties and interests of mines are universal. The man who is crushing quartz in Vermont and the man who is crushing quartz in California would gladly have a common centre for the exchange of their experiences and the instruction of their ignorance. The farmers of the land need such an institution much less, yet they have it in the Agricultural Bureau. To a Bureau of Mining, under competent direction, there is no reasonable objection, except one. An efficient Bureau of Mining is an impossibility. In the first place, its location at Washington would defeat its object; and its location away from Washington would deprive it of the distinctive character and dependence of a bureau, and leave it without any individuality or vigor at all. In the second place, a

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* Recently appointed special commissioner for the collection of mining statistics, vice J. Ross Browne, appointed minister to China.

> bureau is not a progressive institution. The best *savant* in the world, put into a bureau, is liable to crystallise just where he is, and never grow any more. The only way to secure vitality and progress in such an establishment is to make it a school. Only a school can be in constant communication with practical men. People will not spontaneously write to a mere bureau, but the graduates of a school keep up relations with their former comrades and teachers as long as they live.
>
> If, then, the government is to spread among the people that necessary information on the subject of mining and metallurgy, the slow acquisition of which is costing us so many millions every year, and wasting our resources for the years to come, there is no better way than to establish such a school as Senator Stewart proposes, and make it, as it ought to be, the foremost in the world.

The Secretary of the Treasury deems the establishment of a national mining school a matter of sufficient importance to give it favorable notice in his recent report. After detailed reference to the labors of the special commissioner he says:

> Under the most favorable circumstances, such a drain upon our resources as that to which attention is now called would appear to demand the serious consideration of government. The special commissioner recommends, as the only possible remedy, the establishment at some central point west of the Rocky mountains of a national mining school, organised upon comprehensive principles, analogous in its general design and scope to the great mining schools of Europe. By the concentration of scientific experience upon the processes of mining and metallurgy, and the analytical and working tests that could be applied to the different ores, where individual enterprise has so long and so signally failed, it is believed the results would be beneficial. Without assuming to suggest by what means this object could be best accomplished, the Secretary deems it due to the enterprising pioneers of the west, who have opened up a vast empire to settlement and civilization, that their wishes, as represented by the commissioner, should meet with the most favorable consideration. Whatever can be done to promote their welfare will be a national benefit, and none will question that the tendency of scientific institutions is to strengthen the bonds of interest and sympathy between a people separated by a diversity of pursuits and the circumstances of their geographical position.

Differences of opinion may exist as to the means proposed, but it cannot be denied that the Secretary's views on the subject are just and liberal, and merit the favorable consideration of Congress.

A policy is presented, in the bill recently introduced by Mr. Stewart of Nevada, which it is estimated will increase the annual bullion product to more than $200,000,000 within a few years. Now is the time for intelligent action on the subject. The Pacific railroad is opening up direct and easy communication with the great interior of the continent. Our mineral resources are practically without limit. More than nine-tenths of the mines discovered and proved to be valuable are now lying dormant. The question is, will government lend its aid to their development, or be content to ignore this great interest? So far, individual energy has failed to accomplish the objects contemplated in Mr. Stewart's bill. Possibly the miners may be more successful hereafter than they have been for the past two or three years; but the history of mining in other countries does not sustain that hope with reference to a more profitable treatment of the ores, or to the development of mineral lodes now unproductive, or, indeed, to any of the objects designed to be accomplished by the establishment of a national school of mines. It is clear, then, that unless some action is taken on the subject by our government, past experience does not warrant us in expecting an increase of the bullion product in the future.

Mr. Louis A. Garnett, formerly melter and refiner in the United States branch mint, and at present manager of the San Francisco Assaying and Refining Works, says, in a printed letter to the Secretary of the Treasury, that it costs in labor alone $1 80 for every dollar produced from our mines. He bases this estimate upon a population of 100,000 men engaged directly in mining, at the minimum wages of $3 per day for 300 days, and upon a product of $50,000,000. A mining population of 50,000, engaged in actual labor in the mines at $4 per day for 250 days, would probably be nearer the facts. This would give a result of $50,000,000 as the cost for labor alone. Add for current expenses of management, wear and tear of machinery, material, &c., $25,000,000, and you have a total cost, without calculating interest on capital, of $75,000,000 to produce $75,000,000, the maximum estimate for this year; in other words, it costs a dollar to produce a dollar. "Upon what principle of political economy," says Mr. Garnett, "a tax upon the mining interest can be justified I confess I am unable to discover. It practically amounts to taxing a man for the privilege of working at his own expense for the public benefit." If the miners are taxed at all, it would be good policy to apply the tax in such a way as to increase the product of bullion; still better, to take the tax off altogether, and make a direct and liberal appropriation to carry out the object of Mr. Stewart's bill.

While many attach great value to a national school of mines, there are some who cannot see why government might not as well establish a school of agriculture, or a school of commerce, or a school of commercial navigation. In answer to this, it may be said that there is a bureau in the Treasury Department specially designed to promote the interests of commerce and navigation. The Coast Survey, the Light-house Board, the Consular System, the Board of Steam Boiler Inspectors, are all carried on at government expense for the benefit of commerce and navigation. The Bureau of Statistics is an important aid to commerce and navigation. Surely these great interests have no cause to complain. What has government done, on any scale commensurate with these expensive branches of the public service, to promote the interest of mining? Congress has already established a Department of Agriculture, and provided by donations of land for "schools of agriculture and the mechanic arts." But no mining school has been established by any of the States or Territories under the act of 1862. California is about to establish a State university, in which there will probably be a department for instruction in mining, as in some of the colleges of the east, with which this donation has been consolidated. Something, of course, will be gained by such elementary instruction, but these miscellaneous institutions can never prove a substitute for a great central mining school, devoted exclusively to mining. As for commerce, it will take care of itself, with all other schools for the promotion of industry and the products of the earth to sustain it.

Senator Stewart, in his able and elaborate speech of January 16, 1868, says:

> Our mines are the heritage of the whole nation, bought and retained at the expense of common blood and treasure. The nation is interested in making them available for great and beneficial purposes. A debt of gratitude is due to the pioneer who has discovered the hidden wealth of that recently unknown region of the Rocky and Sierra Nevada mountains. It is but just that the mines should be free to him. He must be rewarded for his risks and sacrifices or others will cease to explore, and discoveries of the precious metals will terminate. But it is vandalism to require men to learn the art of mining, not only at the sacrifice of their own labor and time, but at the expense of millions of dollars in waste of the richest ores, while the experience of mankind is of record and could be made available to all by means of a common centre of mining intelligence and instruction.
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> There is another important argument in favor of the development of our mines. The region of country in which they are situated is far removed from market, and the agricultural resources of themselves are insufficient to induce settlements and the development of the fertile valleys and arable lands which we find interspersed among the mountains and deserts. The mines furnish a ready market, enhance the value of the lands, build up agricultural communities, induce the construction of railroads and other internal improvements, cause the erection of manufactories, school-houses, and churches, and attract all the advantages of civilized society. It is highly important that these mountain valleys should be inhabited. They are more healthful and invigorating for the habitations of men than any other portions of the United States. There civilization and free institutions will prosper. We want the Pacific and the Atlantic united by a continuous line of population as well as by railroads and other artificial channels of communication.
>
> It is unsafe for the Pacific slope, with its genial climate, unbounded resources, and vast commercial advantages, soon to be inhabited by many millions of men, to be separated from the Atlantic by hundreds of miles of uninhabited country. The prosperity of the mining interests is the only means that will induce settlement of the intervening space and secure its development.

The following extracts from various eminent authorities are cited in support of the proposed national school of mines:

> It is with indescribable regret that I have seen the youth of the United States migrating to foreign countries, in order to acquire the higher branches of erudition, and to obtain a knowledge of the sciences. Although it would be injustice to pronounce the certainty of their military maxims not congenial with republicanism, it must nevertheless be admitted that a serious danger is encountered by sending about among other political systems those who have not well learned the value of their own. (President Washington to Robert Brooke, esq.)
>
> This species of establishment contributes doubly to the increase of improvement by stimulating to enterprise and experiment, and by drawing to a common centre the results everywhere of individual skill and observation, and spreading them thence over the whole nation. Experience accordingly has shown that they are very cheap instruments of immense national benefit. (President Washington's speech to both houses of Congress, December 7, 1796.)
>
> It is a consolation to observe that under every zone the cultivation of science and art establishes a certain equality among men, and obliterates, for a time at least, all those petty passions of which the effects are so prejudicial to social happiness. (Baron Humboldt.)
>
> Settled by the hard labor of human hands, they [the regions of the West] are now to be settled by the labor-saving arts, by machinery, by the steam engine, and by internal improvements. Hitherto the work to be done was that which nothing but the tough sinews of the arm of man could accomplish. (Edward Everett's Orations and Speeches, vol. 1.)
>
> Industrial enterprise is everywhere stimulated; the paths of adventure are opened; the boundless west prevents the older settlements from being overstocked, and gives scope for an unlimited development of energy. Education is wanted to enlighten and direct these active, moving powers. Without it, much wild vigor will be exerted in vain. Energy alone is not enough; it must be turned to feasible objects, and work by sound principles. (Edward Everett's Orations, vol. 2.)
>
> The history of the progress of the human mind shows us that, for want of a diffusion of scientific knowledge among practical men, great evils have resulted, both to science and practice. (Edward Everett, vol. 1.)
>
> If to the ingenuity of the New World, the thoroughness, the patience, and the science of the Old could be added, far greater results might be expected than those we now attain. (North American Review.)
>
> Private establishments are defective in their constitution, limited in their operation, and incapable, from their very nature, of developing and directing and rewarding the indigenous talent of the country. They are under no obligation to do the scientific work of the State, or to promote any of those national objects which are intrusted to the organised institutions of other lands. (Sir David Brewster, address before the British Association, July 31, 1850.)
>
> It is only experience, aided by science, that is rapid in development and certain in action. (Lyon Playfair, C. B., F. R. S.)
>
> Mining schools have long existed in France, Russia, Prussia, Saxony, Austria, Spain, Sweden, and other countries even less connected with mining; and their practical value is recognized by the fact that the respective governments of these states have found it necessary to develop still further the educational resources of such institutions. The want of similar establishments in this country has long been felt in mining districts, and has been expressed both in Parliament and in memorials addressed to the government. In the report of the committee of the House of Lords, (1849,) the committee observed that "among those best qualified to speak upon this point, a want appears to be felt of facilities for acquiring mining education, such as provided by the mining schools and colleges established in the principal mining districts of the continent, apparently with the most beneficial effect." (Prospectus government school of mines, London, 1852-3.)
>
> Looking at the class of men who, in this kingdom, are intrusted with the direction of collieries and mines, we find them, in general, characterized by a remarkable degree of energy and intelligence; and yet it cannot be denied that independently of the losses entailed by the uncertainty of mineral veins, large sums are yearly squandered on ill-judged, and sometimes even absurd speculations, which a greater amount of experience on the part of the proposer would have taught him to modify or abandon. (Wrightman, Geological Survey, Great Britain.)
>
> It is conceded to agriculture that the fruits of the earth, reproduced annually, can be stimulated by an application of acquired knowledge, connected with practical training, upon a farm conducted upon the principles taught, where theory and practice are combined. But it is denied to mining, a pursuit in which

> nature gives but one crop, with the production of which man has not assisted, and where all the knowledge demanded is to secure the production at hand by the most expeditious, economical, and safe means which experience and science furnish. (Gregory Yale, Titles to Mining Claims.)
>
> The arts of mining and geology mutually support and illustrate each other. As the geologist is indebted to the labors and observations of the miner for many important facts relative to the formation of the crust of the earth, so the miner must possess some degree of geological knowledge if he desires to ascertain the presence of useful minerals in his district, such as ores, precious stones, rock salt, &c. He who abandons the simple and correct way pointed out by geological experience, runs the risk of groping in conjecture and doubt, and this is of particular importance in mining, for it is an enterprise brilliant and full of promise, and at the same time expensive, and often illusory. (Professor R. C. Von Leonhard, University of Heidelberg.)

Of the importance of an increased product of the precious metals there can be no question. The ablest political economists of Europe and America are unanimous upon that point.

Mr. Seward, in the course of a debate in the Senate shortly after the admission of California into the Union, said:

> The objects of the United States in regard to the gold mines in California should be, in the first place, to bring to the general public use of the people of the United States the largest possible acquisition of national wealth from their newly-discovered fountains; and secondly, to render the mining operations conducive to the best and speediest possible settlement of our vast countries on the Pacific coast, which are so soon to exercise boundless commercial, social, and political influences over the eastern world.

Mr. Benton was "decidedly of the opinion that the United States ought not to undertake to make a revenue out of the mines; that the United States ought to content herself with getting the wealth out of the bowels of the earth itself."

Sir Archibald Allison, referring to the wonderful effects of the gold discoveries in California and Australia, makes use of this emphatic language:

> That which for five and twenty years had been wanting—a currency commensurate to the increased numbers and transactions of the civilized world—was now supplied by the beneficent hand of nature. The era of a contracted currency, and consequent low prices and general misery, interrupted by passing gleams of prosperity, was at an end. Prices rapidly rose; wages advanced in a similar proportion; exports and imports enormously increased, while crime and misery as rapidly diminished.

Mr. Conness, always earnest in his advocacy of great measures for the development of the material resources of the Pacific slope, said, in the course of the debate on the mineral land bill:

> I will not undertake to extend this debate or the consideration of this question by entering into an estimate of what the production of gold costs. It would be mere guessing at best; but I undertake to say that there is no commodity which the enterprise and commerce of our country and of the world require so much as the addition to our circulation of the precious metals. I need not waste a word in stating how it incites the trade and commerce of the country, and of the whole world.

Mr. Nye said, in the course of the same debate:

> I beg the Senate to bear in mind the fact that every additional dollar of gold and silver that we produce lays the foundation of our financial structure on a more stable foundation. Let it be known that we can produce gold and silver to make our credit always secure and sure, that the interest will be paid in the precious metals, and our credit will stand as high if not higher than that of any other nation of the earth.

The importance of such an increase to the United States has been forcibly presented by the Committee on Public Lands of the House. Mr. Julian, the intelligent chairman of that committee, who very ably supported the policy of granting absolute titles in fee to the miners, though opposed to the form of the bill reported by the Senate committee, says, in a report on the mineral lands, dated June 5, 1866:

> In the judgment of the committee there is very great need of an increase in the quantity of precious metals. The disproportion of gold and silver to other values, and to our commercial wants, is very remarkable. If practicable, it should be reduced. The property of the United States, within the last ten years, has increased about $900,000,000 per year; and this increase is estimated to be more than two hundred times greater than the increase of coin during the same period. It is believed that some policy which will secure to the government a fresh and liberal supply of the precious metals will be found absolutely necessary.

Mr. Robert J. Walker, the distinguished statesman and financier, says, in a recent able letter:

> All the benefits of skill and experience derived from years of devotion to business pursuits, are lost through fluctuations in the currency, which no sagacity or skill can anticipate. When we reflect that each nation is but a part of the great community of states, united by ties of commerce, business, and interchanges, and find the rest of the world sustained by a specie currency, which is of uniform, universal international value, how can we who are dealing with depreciated paper expect to compete successfully with those countries whose money is gold, or its actual equivalent? No nation has ever tried this experiment without vast sacrifices and great failures. So long as the currency of the world is gold, any nation departing from this standard impairs its own power of successful competition, and gradually drives its products from the markets of the world. It is true that it may, to a certain extent, so far as smuggling does not open the safety-valve, keep out foreign imports for a time, thereby annihilating its exports; but prices soon rise at home in a ratio corresponding with the augmented duties, and, the check becoming ineffectual, is sought to be remedied by augmented tariffs. It is totally impossible for a nation like the United States to withdraw from the business operations of the world, and it is equally impracticable to carry on successful international exchanges when the money of the country is depreciated paper.

December 2, 1867, Mr. Stewart, United States senator from Nevada, asked, and by unanimous consent obtained, leave to bring in the following bill, which was read twice and ordered to be printed; December 3, 1867, referred to the Committee on Mines and Mining; February 20, 1868, reported by Mr. Stewart, with amendments.

A BILL to establish a national school of mines.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the tax levied and collected upon gold and silver bullion in the States and Territories situated in whole or in part west of the eastern base of the Rocky mountains be set apart, so long as the same shall be collected by the government, as a special fund for the endowment and support of a school of mines, to be located on the line of the Pacific railroad, west of the Rocky mountains, as near as practicable to the centre of the mining States and Territories.

[SEC. 2. *And be it further enacted*, That each State and Territory located in whole or in part west of the eastern base of the Rocky mountains may appoint one member of a board of directors, a majority of whom shall constitute a quorum; and in case of failure on the part of any State or Territory so to appoint, the President shall appoint such member by and with the advice and consent of the Senate; but no part of the fund herein provided for shall be expended in salaries, travelling or other personal expenses of the said board of directors.]

SEC. 2. *And be it further enacted*, That the management of the institution shall be under the control of eight directors, a majority of whom shall constitute a quorum. The directors shall be selected from the mining States and Territories, and appointed by the President, by and with the advice and consent of the Senate, and shall hold their office for four years, and until their successors are appointed and qualified: *Provided*, That the following named persons shall constitute the board of directors from the first day of July, anno Domini eighteen hundred and sixty-eight, until the first of July, eighteen hundred and seventy, namely: Sherman Day and William Ashburner, of California; F. A. Tritle and D. W. Welty, of Nevada; A. C. Gibbs, of Oregon; —— ——, of Idaho; A. J. Simmons, of Montana; and John Pierce, of Colorado. In case of failure of any of the above-named persons to serve, or should a vacancy occur from any other cause, the same shall be filled as hereinbefore provided. The directors shall receive no compensation for their services, but their actual travelling and other expenses incurred while attending to the business of the institution shall be paid.

SEC. 3. *And be it further enacted*, That the said board of directors shall have power to make rules and regulations for the organization and government of the school; shall appoint its professors, teachers, and officers, and exercise supervision and control over the fund herein appropriated.

SEC. 4. *And be it further enacted*, That no professor or teacher [or other officer] of this institution shall be removed except upon charges and specifications duly investigated by the board of directors, and the decision of the Secretary of the Treasury, to whom the facts and the evidence shall be reported, shall be conclusive.

SEC. 5. *And be it further enacted*, That tuition in this institution shall be free to any citizen of the United States who may present proper evidences of qualification, to be determined by the faculty; and it shall also be free to students from other countries, duly recommended by the authorities of the schools in which they shall have become qualified; but all expenses for books and stationery, and all personal expenses for lodging, subsistence, and travelling, shall be borne by the students themselves.

SEC. 6. *And be it further enacted*, That the primary object of the school being an increase of the bullion product of the country, by the practical application of science to mining, and the diffusion of correct knowledge among miners as to the best methods of treating the ores, no charge shall be made for assays, tests, metallurgical or other experiments, except to cover the actual cost of material used.

SEC. 7. *And be it further enacted*, That the Secretary of the Treasury, on and after the first day of July, eighteen hundred and sixty-eight, shall set apart the fund hereby appropriated for the purpose named in this act; and he shall, after receiving a report from the board of directors, locate the school and furnish plans and specifications for all necessary buildings and improvements, which shall be plain and substantial, and upon the most economical plan consistent with the purposes of the institution.

SEC. 8. *And be it further enacted*, That in order that the board of directors may be placed in possession of the most approved systems of education, the Secretary of the Treasury shall cause an examination to be made of the principal mining schools of Europe, and a report to be prepared upon the same, the expense of such service to be paid out of the [unexpended balance of the appropriation heretofore made for the collection of mining statistics] funds of the institution.

SEC. 9. *And be it further enacted*, That the duties now performed by the special commissioner appointed by the Secretary of the Treasury to collect mining statistics in the States and Territories west of the Rocky mountains, shall, upon the organization and completion of the school of mines created by this act, be performed under a permanent system by the faculty of said institution, and their report shall be transmitted to the Secretary of the Treasury, to be by him laid before Congress.

SEC. 10. *And be it further enacted*, That the professors and teachers, under the direction of the president of the institution, shall make [annual] visits to the principal mining districts, accompanied by their respective classes, for the purpose of examining the mines, mills, and modes of working, and instructing the pupils in the practical operations of mining and metallurgy; and the said professors and teachers shall also, as far as their time will permit, give free lectures to the miners on geology, mineralogy, metallurgy, and mining engineering, and kindred subjects. And the faculty may require, as a part of the regular course of instruction, the pupils to engage for a prescribed period in practical mining and milling.

SEC. 11. *And be it further enacted*, That the Secretary of the Treasury shall require from the directors and from the disbursing officer or officers appointed by the board of directors such bonds and vouchers as he may deem necessary for the security and proper disbursement of the fund.

SEC. 12. *And be it further enacted*, That from and after the expiration of the fiscal year commencing July first, eighteen hundred and sixty-eight, not exceeding one-half of the fund arising from the tax levied upon gold and silver bullion shall be expended by or on behalf of the institution, the [remaining half to] remainder shall be set apart by the Secretary of the Treasury and invested in government securities, which shall remain, both principal and interest, a permanent fund for the support and maintenance of the institution; and no part of the moneys so reserved, [half] either principal or interest, shall be drawn so long as the government shall continue to impose a tax upon gold and silver bullion, but after such tax shall have ceased the interest on the reserved fund shall be used for the purposes hereinbefore mentioned.

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